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ABSTRACT

This paper examines worldwide housing problems. The rising prices of materials, energy, and land ensure that buying, building, and maintaining even the most elementary shelter today costs several times what it did a decade ago. People in industrial countries must spend an even larger share of their income if they want to buy a home. Those who cannot afford to buy a house are finding a scarcity of rental units. There is mounting despair about shelter conditions in the Third World, as it becomes apparent that most people will never live in homes that reach the standard now found in industrial countries. A number of specific topics are examined. First, the difference between housing needs and housing demand is discussed. The need for housing is primarily a function of population growth. Housing demand is the result of the impact of both population growth and economic variables. The changing housing stock (new units flowing in vs. old units flowing out) is then examined. Resources--type of land house stands on and materials, labor, financing, and energy that go into building a house--are the third topic treated. The fourth topic dealt with is the role land plays in the housing market. Other topics examined are old and new building materials, energy, financing, the home of the future, and housing policies in an era of limits. (Author/RM)

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Global Housing Prospects: The Resource Constraints

Bruce Stokes

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A man's home is his castle, or so the saying goes. This adage reflects people's desire to have some control over the size and the condition of their homes. Unfortunately, the rising cost and growing scarcity of many basic housing resources is taking that control out of their hands. More than ever before, access to land, building materials, capital, and energy is shaping the homes people live in. In the industrial world, the spacious, well-equipped, single-family dwelling that during the sixties and seventies became the goal of many households is increasingly beyond the reach of many. As a result, more people will live in townhouses or apartments that are smaller and have fewer of the amenities Westerners have come to expect. Resource constraints will also make it more difficult to improve the crowded, inadequately serviced squatter shacks and squalid tenements that shelter most of the world's poor. If population growth continues apace, the number living in such conditions is bound to grow. During the seventies, energy constraints redefined the size of the automobile, the materials used to manufacture it, and the ways in which it was used. In the eighties, housing resource constraints will reshape the average new home and change the living patterns of people everywhere.

These constraints on housing resources are already being felt. The United Nations estimates that authorized construction annually falls four to five million housing units behind demand in Third World cities alone. This shortfall comes at a time when at least 800 million people are living in poorly built dwellings in squatter settlements and rural villages. Moreover, 1.8 billion people do not have access to adequate sewage disposal and 1.3 billion lack clean water. In many countries, efforts to provide housing and related services are losing the race with population growth.[1]

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The problem of the quality of housing has been compounded by rising costs. During the last decade, the average price of a new home in most countries rose faster than inflation. The median price of a new house in the United States was $64,500 in 1980, compared with $23,400 in 1970. Japanese homebuyers faced an even more startling
6 23 percent price increase in 1980 alone, and now pay on average $137,000 for a house in Tokyo or Osaka. Although no comparable statistics exist for the Third World, the rising prices of materials, energy, and land ensure that building and maintaining even the most elementary shelter today costs several times what it did a decade ago.[2]

This escalation in housing costs has begun to take its toll. People in industrial countries must spend an ever larger share of their incomes if they want to own a home. And those who cannot afford to buy a house are finding a scarcity of rental units, for governments and private investors are reluctant to build such housing because rents have been rising slower than expenses. In their search for less expensive homes, affluent householders are competing with the poor, the elderly, and with minorities, displacing them and often forcing people into substandard, overcrowded, costlier housing. Frequently, the displaced do not go peacefully; rioting has erupted over inadequate supplies of moderately priced housing in London, Amsterdam, and Berlin.

Even the state-controlled economies of Eastern Europe face cost constraints. The Soviet Union has been forced to cut back on new homebuilding despite the fact that 30 percent of its people still live in communal groups, either in apartments or in factory dormitories. One-half to two-thirds of the poor in Latin America, Africa, and Asia already cannot afford to purchase even the cheapest conventional dwelling. As prices rise, the squatter settlements in major Third World cities are spreading at unprecedented rates. Trying to keep housing costs to a minimum, the poorest of the poor live in drainage pipes, under bridges, or in cemeteries, anywhere they can put a roof over their heads.[3]

Rising prices are turning the dream that millions have of owning a home into a nightmare. In 1981, four out of five Americans felt that in the future most people will not be able to afford the kind of housing they want. They are not alone in their fears. Two in five householders in Japan and three of every five in France have expressed

dissatisfaction with their current homes. At the same time, there is mounting despair about shelter conditions in the Third World, as it becomes apparent that most people will never live in homes that reach the standard now found in industrial countries.[4]

In the past, public efforts to deal with rising costs and deteriorating housing conditions have relied on building more units in the hope that sheer volume would somehow solve the shelter problem. Today, as the limits of the world's finite resources become clear, more finely articulated housing policies are called for to better manage both the demand for shelter and the supply of housing resources.

Shelter Needs, Housing Demand

Among housing economists, there is a continuing debate over the difference between housing needs and housing demand. The distinction is far from academic, for it helps differentiate the growth in shelter requirements that is inevitable from that which is variable, depending on economic conditions and social trends.

The need for housing is primarily a function of population growth—through natural increase or migration—and the age distribution of a population. The inadequate supply and poor quality of much of the housing in Africa, Asia, and Latin America in part reflects the rapid growth in human numbers in these areas. Housing demand, on the other hand, is the result of the impact of both population growth and economic variables—a family's income, the cost and availability of financing, and the price of various housing resources—on patterns of household formation. The cost and quality of housing in North America, Europe, and Japan are currently largely defined by this interaction.

In mid-1981, the world's population stood at 4.5 billion and it was expected to reach 6.1 billion by the year 2000. Within a century and a half, according to United Nations estimates, population should stabilize at about 10.5 billion. Providing adequate shelter for this many people will stretch the resources and test the ingenuity of all societies. That burden will fall most heavily on the poorest economies. Although less developed nations must house 75 percent of humanity today, their portion is expected to grow to 86 percent by the time population growth stabilizes.[5]

Sheer numbers, however, do not convey the true nature of the shelter requirements connected with growing populations. Initially, rapid growth does not create much new need for housing. The spurt of housing construction in the United States in the fifties was as much a result of rising affluence and the backlog of two decades of unmet demand as it was a reaction to the baby boom. The real impact on the housing market of a baby boom comes about 20 to 25 years later, the "echo" of the boom, when people born during the boom years begin to form families of their own. Such a homebuying tidal wave hit the industrial nations in the seventies and will continue through the eighties. Within a decade, however, the portion of the population in the prime homebuying group of ages 25 to 44 will begin to shrink as the fall in birth rates that started in the sixties begins to take effect.

The surge in population growth came later in the Third World, as the result of improvements in health care and nutrition, and the full impact on the housing market is only beginning to be felt. In India, the proportion of the population aged 25 to 44 will grow from 24 percent in 1980 to 29 percent in the year 2000. In the less developed world as a whole, the number of people in the household-forming portion of the population will increase by 600 million during this period. It is sobering to realize that in the Third World, which already faces substantial housing difficulties, the number of people entering the housing market today is only 58 percent as large as the number who will be looking for homes at the turn of the century.[6]

Migration patterns are now adding to these population growth pressures, focusing housing demand in urban areas where land and building materials are already at a premium. Rural-urban migration and the movement from small towns to large ones are particularly acute in the Third World, while migration from declining urban areas to new boom towns is an emerging problem in the United States. Demographers expect that half the world will be living in cities by the year 2000. Although urban settings originally provided an opportunity to deliver housing and services efficiently to large numbers, the emerging urban agglomerations turn efficiency on its head. Migrants are preponderantly young adults in their family-forming years whose housing needs tend to expand rapidly after resettlement, stretching the capacity of even the most elementary construction industries. The press of people crowded into cities forces up the price of land and often overruns

"The pace of household creation in the industrial world peaked in the seventies and will decline over the next 20 years."

nearby agricultural land. Moreover, migration often means buildings are abandoned in the places migrants left, be it rural Mexico or the South Bronx, resulting in an underuse of a nation's total housing stock.[7]

The combination of population growth and migration threatens to create an acute housing crunch in some nations. The populations of Kenya and Nigeria are expected to double by early in the next century. Their major cities—Nairobi and Lagos—are growing even faster.[8] This short lead time makes it extremely difficult for governments to mobilize the necessary financial and material resources to adequately shelter their people. Many of the trees needed as construction lumber should have been planted already, for example, but have not been. If new homes are to have the most basic services, governments must soon begin to build the necessary water and sewage systems as well as power plants. The vast amounts of capital needed to finance new housing must be accumulated, yet appropriate savings institutions are nowhere in place.

Population size is, however, only a rough indicator of a society's housing requirements, as it does not account for the many other social and economic influences on housing demand. A more precise measurement is the rate at which new households are formed—through marriage, divorce, children leaving home, and so forth. In general, like the share of the population that is of household-forming age, the pace of household creation in the industrial world peaked in the seventies and will decline over the next 20 years. (See Table 1.) In Japan, for example, the rate of growth will drop from 2.9 percent in the early seventies to 1.2 percent in the late nineties. In the Third World, by comparison, the rate of household formation in most societies will continue to rise through the end of the century, reaching 3 or 4 percent in some countries by the year 2000.

The timing and the pace of household formation are primarily determined by people's incomes. Unprecedented rises in incomes over the last two decades in Western Europe, Japan, and North America enabled many people to form new households. With more financial resources at their disposal, married couples moved out of the homes they had been sharing with their parents. New job opportunities for women and rising incomes brought more female-headed households into the housing market. In the United States, income became in-

Table 1: Average Annual Growth in the Number of Households in Selected Countries, 1970-75, with Projections to 2000

Country	1970-75	1980-85	1995-2000
		(percent)	
Algeria	2.8	3.9	4.2
Bangladesh	1.5	3.1	3.3
Indonesia	2.6	3.1	3.3
Japan	2.9	1.9	1.2
Kenya	3.3	3.4	3.7
USSR	2.4	2.1	1.3
United States	2.0	2.0	1.1
West Germany	1.2	1.0	0.5

Source: United Nations, *Compendium of Housing Statistics.*

creasingly concentrated in the hands of two-income families, giving them greater leverage to buy a home. Thus while in one out of five households both partners are employed full time, a 1979 survey in Chicago showed that such two-income couples represented three-fifths of all homebuyers. Moreover, with higher total incomes, young people could afford to purchase their first homes earlier than couples could in the past. Overall, at least in the United States, more than one-fourth of the demand for new housing during the seventies was directly due to the historically unprecedented formation of new households, largely as a result of higher incomes.[9]

The rising incomes of the most likely homebuyers do not fully explain the record strength of the housing market in the industrial world over the last decade. Homeownership rose in almost every nation because the tax advantages (especially for two-income families in the United States and the United Kingdom), the relatively low cost of mortgages in many countries, and the rapid appreciation of housing values made homes an attractive investment. As houses became both physical and financial shelters, there was a scramble to get into the market, sparking short-lived housing booms in Japan in 1973 and in the United States in 1978.[10]

The impact of higher incomes on housing patterns has been amplified by recent social trends. The most notable of these, in terms of new

"As houses became both physical and financial shelters, there was a scramble to get into the market."

housing demand, has been the fission of both the nuclear and the extended family. The divorce rate has risen steadily over the last two decades in a number of countries, doubling over the last 20 years in both the United States and West Germany, for example. And although most young adults used to live with their parents until they were married, custom now dictates that they move out after they complete their schooling. Thirdly, the combination of increased longevity and improvements in government income maintenance has meant more elderly people living on their own for a number of years rather than with their families or in institutions. As a result of these social changes, one-person households in the United States grew in number by 54 percent over the last decade and currently account for more than one in every five households.[11]

Many of the conditions that recently increased housing demand will not continue in the years ahead. By the end of the century, the number of people entering the homebuying age-group in industrial nations will be about the same as the number passing out of that age-group.[12] In the early part of the next century, there will be a minor surge in demand for housing—the echo of the echo—as the children of people born during the postwar baby boom begin looking for homes of their own, but the rise will be less than half that experienced during the seventies and eighties. In the Third World, birth rates have already begun to fall in a number of countries. If these trends continue and spread, then housing demand there will slacken sometime during the first decades of the twenty-first century. The rush to the cities in parts of Africa, Asia, and Latin America may begin to slow or even reverse if conditions in urban areas continue to deteriorate and if the quality of life in rural areas improves.

Anticipated changes in the social trends affecting patterns of household formation are more difficult to predict with any certainty, although they would appear to increase the demand for housing. The divorce rate in North America and Europe is likely to remain high, at least temporarily creating two households where previously one existed. As Western cultural influences spread, divorce rates in many traditional societies could increase. The rising age of marriage almost everywhere increases the chance that more young adults will want to set up housekeeping on their own. One of the biggest imponderables in forecasting housing demand is the future living patterns of the elderly. Over the next half-century, people over 65 will represent an

ever greater share of the population in industrial countries, potentially creating an explosive demand for housing to meet their needs.

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These social trends pit the forces of modernization, which have added to housing demand in the past, against projected worsening economic conditions, which could inhibit future household formation. If, for example, improved job opportunities for women over the last decade enabled some couples to end bad marriages, tougher times may begin to undercut the ability of women in such situations to strike out on their own. Similarly, some young adults are already living with their parents beyond the age their older brothers and sisters did, largely because of the rising costs of rents and mortgages. Group living by unrelated individuals, a traditional indicator of a lack of affordable housing, is also on the increase.[13] And in years ahead, as a shrinking portion of the population works to support the elderly, having retired people live in homes of their own may be something society can no longer afford. Poor job prospects in the Third World may further delay the age of marriage, while keeping young people at home with their parents. Declining employment opportunities in cities could slow migration and the split-up of families, thus reducing urban housing demand.

The broad parameters of shelter needs over at least the next quarter-century have been determined by the number of people already born. But within those boundaries housing demand will respond to economic and social trends. The volatile nature of these trends suggest a housing future quite unlike the immediate past.

The Changing Housing Stock

Much of a nation's wealth is tied up in its homes. In the United States, for example, the stock of private houses, rental properties, and public housing is worth more than $3 trillion. This is roughly comparable to the value of all private business assets, including equipment, factories, and manufacturing stocks. The sheer magnitude of this capital asset assures housing a central role in modern economies.[14]

A society's shelter stock is essentially a pool. New units flow in as a result of construction, conversions, and rehabilitation; old units flow out because of demolition, abandonment, and conversion to non-

residential use. Over the last half-century, the annual new construction of homes in most industrial countries has averaged about 3 percent of existing housing stock. This addition to the number of dwellings has been partially offset by losses of about 1 percent per year, resulting in a net annual increase in the housing stock of roughly 2 percent.[15]

In most industrial countries, new construction averages between six and ten housing units per 1,000 population each year. But rates range from Japan's recent average of 15.7 to Italy's 4.3 units. International comparisons of per capita housing construction are often deceptive. Annual construction fluctuates wildly depending on economic conditions and industry bottlenecks. In the late seventies, however, there was a marked decline in homebuilding in a number of countries, with a fall of 41 percent in West Germany and 16 percent in France from 1973 to 1977.[16] The drop was in part a natural letdown after the intense amount of building following World War II. Also, the home-buying age-groups in most countries had begun to shrink. But the falloff in building also reflects the growing scarcity and rising cost of housing resources and the consumer's inability to pay more and more for shelter.

This broad overview, however, obscures some recent national successes in meeting housing demand as well as some notable failures. Each year during the seventies, the United States built an average of 1.7 million units and the four major West European nations built a total of 1.5 million. Home construction consistently exceeded the need dictated by population growth and by the formation of new households. Over time the housing stock per capita grew. In 1960, the United States and several European countries had slightly more than 300 residences per 1,000 people. By 1980, the United States had 390 and a half dozen European countries had more than 400 units per 1,000 population. Such was not the case in the Soviet Union, where current annual construction by the largest housing industry in the world is not even able to keep up with the marriage rate. As a result, despite building on average 2.2 million units per year, waiting lists for new homes were longer in 1980 than in 1970 and the Soviet Union still has less than 300 units per 1,000 people.[17]

New construction is not the only source of additional housing. During the seventies, conversions, subdivisions, and rehabilitation of pre-

viously abandoned properties in the United States contributed roughly 600,000 units per year to the housing stock—about one-third of the average annual new construction. As the cost of new housing rises, alternatives to new construction could be a major source of homes, especially in older cities with a great deal of abandoned residential, commercial, and industrial space. Urban planners should take a new look at such vacant property, this time seeing it as an opportunity for creative housing rather than a problem of urban blight.[18]

Even as the housing stock grows, the mix of housing units being built is constantly changing. Single-family homes, long a symbol of independence and status, are the most common type of shelter in Western Europe and North America. In the Soviet Union and parts of Eastern Europe most people live in multifamily dwellings. During the sixties, public and private builders broke ground for a record number of multifamily dwellings, in the hope of rapidly improving shelter conditions at a low cost. While construction of multifamily units has slowed, the large number of older single-family units being abandoned each year has meant that the portion of the population living in multifamily units continues to grow in the United States, West Germany, and France.[19]

One of the most rapidly developing residential construction trends in the seventies was the emergence of the mid-size housing market—two to four units per structure. In the United States, these small multifamily units grew from 5.1 percent of new construction in 1974 to 8.5 percent in 1980. Similar building patterns can be seen in Finland, the Netherlands, and parts of Eastern Europe. And the number of mobile homes in the United States almost doubled in the seventies; today there are nearly four million mobile homes in year-round use—enough to house the entire population of New York City.[20] Low-density multifamily units and mobile homes have an important role to play in meeting future housing demand because they offer many of the amenities of living in a free-standing single-family dwelling—privacy, independence, and so forth—at a lower price and resource cost.

Changes in the composition of the housing stock have been paralleled by changes in housing quality. Floor space in the typical new single-family house in the United States has nearly doubled over the last 30 years. Most American homes are comparatively spacious—nearly

"The average size of new housing units in the United States peaked in 1978."

triple the average size of new units in the USSR and one-third larger than those in West Germany. (See Table 2.) All this may be changing, however. The average size of new housing units in the United States peaked in 1978 at 142 square meters (1,527 square feet) and dropped to 140 square meters (1,510 square feet) by 1979. The further decline to 136 square meters (1,464 square feet) in 1980 signals a new era of smaller houses. Similar trends seem to be emerging in Sweden and Canada, while in parts of Eastern Europe the annual increase in the average size of dwellings slowed markedly from the sixties to the seventies.[21] These figures suggest that as the current housing stock ages, existing residences in many countries will be replaced with less spacious units. This would mark the first time in industrial countries that a traditional indicator of housing quality—more space—has reversed direction.

Table 2: Average Usable Floor Space of Completed Single- and Multi-family Dwellings in Selected Countries, 1960-79

Country	1960	1970	1975	1978	1979
			(square meters)		
Hungary	57	61	63	65	66
Sweden	69	80	101	115	114
USSR	42	47	49	51	51
United States	n.a.	n.a.	133	142	140
West Germany	71	84	91	103	n.a.
Yugoslavia	48	59	64	67	n.a.

Source: Bureau of the Census, *Characteristics of New Housing*; Economic Commission for Europe, *Annual Bulletins of Housing and Building Statistics*.

As houses were growing larger during the sixties and seventies, the average number of people living in each American home was shrinking. As a result, in a world where most people live two or three to a room, over half of all American homes have two rooms for every occupant. Given the smaller houses coming onto the market, however, unless the average number of people per household continues to shrink appreciably, there may be little further increase in per capita living space. This is not necessarily bad, of course, for Americans already have nearly twice as much living space per person as the American Public Health Association recommends as a minimum.[22]

Over the last generation, there has also been a qualitative change in the definition of a standard home, especially in the United States. As recently as 1950, one in three American housing units lacked some or all plumbing. By 1976, the figure had dropped to one in 29 units. In 1960, one-eighth of all American housing units had air conditioners; by 1978, half were air-conditioned and nearly half of these had central systems. There has been a similar growth in the number of homes with garages and second bathrooms.[23] This means Americans have the best housing in the world, but at a high cost in housing resources. In the face of escalating energy and materials prices, other nations may never be able to house their people in the style Americans became accustomed to during the seventies.

This is particularly true in light of recent unprecedented increases in housing costs nearly everywhere. In the sixties, the average price of a new home in Western Europe, North America, and Japan increased at a moderate annual pace, ranging from 4 to 7 percent. (See Table 3.) During the seventies, prices rose dramatically, averaging 6 to 10 percent increases each year. In many countries, housing costs have been rising faster than the consumer price index, indicating that shelter is becoming less accessible to the average consumer in relation to other purchases. The high interest rates of the early eighties may dampen

Table 3: Average Annual Increase in the Cost of New Housing in Selected Countries, 1960-79*

Country	1960-70	1970-79
	(percent)	
France	4.7	9.9
Netherlands	6.6	10.2
Japan	6.5**	8.2
Sweden	4.0	10.0
United Kingdom	3.8	5.9
United States	3.9	9.6
West Germany	5.5	6.3

*for Japan, Sweden, and US in 1960-70, figures are cost of inputs only
**for 1965-70 only
Source: Economic Commission for Europe, *Annual Bulletins of Housing and Building Statistics;* Bureau of Statistics, *Japan Statistical Yearbook 1978.*

prices somewhat, but ever higher resource costs mean that the moderate housing price rises of the sixties will remain a thing of the past.

In the Third World, the housing patterns of the last few decades are far more complex than those in industrial countries and defy simple comparison with the Western experience. The number of conventional housing units built in most Third World countries is only a fraction of that built in the West—usually less than two per 1,000 population. These official housing statistics are notoriously inaccurate, however. The total number of homes built is probably closer to eight per 1,000, given that as much as three-quarters of the construction takes place in the informal sector.[24]

The importance of this informal sector is obvious in many Third World cities, from Cairo to Mexico City to Jakarta. Visitors are initially struck by the many new high rises on the skyline, but when they lower their sights it quickly becomes apparent that the most substantial growth in housing occurs in the squatter settlements of low-rise dwellings surrounding these modern towers. The United Nations estimates that squatter settlements now represent up to 60 percent of the housing in cities such as Ankara, Bogota, Calcutta, and Kinshasa.[25]

The shortfall in "official" housing supply in developing countries is often seen as the main shelter problem in the Third World. In Egypt, for example, the urban housing deficit was estimated in 1975 to be 1.5 million units. In India, in 1973, it was put at 3.8 million units.[26] These staggering numbers do not represent a problem in themselves, however, because the informal sector makes up most of the difference. But the figures do suggest that talk of official shortfalls as a "problem" is misleading, for official housing can never be the solution. The real shelter problem in the Third World is the price and quality of informal housing.

The poverty in squatter settlements has shaped a hybrid type of housing that clouds the distinction between single- and multifamily dwellings. Many of these households are really extended families, encompassing aunts, uncles, and cousins. Many take in boarders. In fact, more than half the squatters in the Dandora settlement in Nairobi rent out a room to a nonfamily member.[27] Low-rise multifamily dwell-

ings in the informal sector are the main form of housing in Third World cities because they permit high density at a low cost. Population and economic projections suggest they must continue to be the most common form of housing there for some time to come.

18 Housing conditions in developing countries are abysmal. According to the United Nations, as many as seven out of ten homes in rural areas of developing countries are currently unsuitable for human habitation and require replacement or major alteration. Houses in cities are hardly better. One recent survey in Kanpur, India, showed that three-quarters of the dwellings had no windows and two-thirds became waterlogged when it rained.[28]

Surveys of the informal housing sector, which covers more than half the population, suggest that most people are forced to live in severely crowded conditions. In India, for example, although officially there are 2.8 people per room, unofficial estimates indicate that two-fifths of the urban population live in one-room houses sheltering an average of 4.6 people. A 1978 survey of Chinese cities indicated that per capita living space actually declined by nearly one square meter since 1949.[29] Under such conditions, basic sanitation and elementary privacy are nearly impossible.

The issue of housing density is indicative, however, of the cultural difficulties of comparing shelter statistics for industrial and developing countries. In the United States, crowding is defined as more than one person per room. By this definition, almost all Third World housing is extremely overcrowded. But the cases of families who, packed like sardines, sleep in shifts in fetid hovels are the exception not the rule. People in traditional societies, especially in tropical areas, often spend a great deal of their time outdoors, cooking in courtyards and socializing in open areas. In dry weather, they even sleep outside. Under these conditions, crowding is a less serious problem. A more relevant barometer is total population density in urban areas, which is indeed increasing throughout the Third World. This figure may more accurately reflect changes in the quality of life because it takes into account both public and private space and gives some idea of the strain on public services caused by burgeoning city populations.

Some housing amenities have slowly begun to improve, however. The World Health Organization (WHO) estimates that the share of the

"Two-fifths of the world's population still live in homes without the barest of necessities."

worldwide urban population supplied with clean water, either in homes or through public standpipes, has increased from 58 percent in 1962 to 75 percent in 1980. Although only one in seven rural households had access to clean water in 1970, the figure rose to more than one in four by 1980. These are hopeful signs, yet the fact remains that two-fifths of the world's population still live in homes without the barest of necessities. And, on the negative side, WHO estimates that the proportion of the world served by adequate sewage facilities has actually decreased.[30] It is doubtful that any momentum in improving basic amenities can be maintained if Third World populations double or triple in size, as it is now expected. The sheer magnitude of these numbers will surely overwhelm already overstretched public services.

The future supply and quality of housing in both industrial and agrarian societies is difficult to predict. American housing analysts often claim that U.S. construction could reach as much as three million units per year, if need be. Housing officials in developing countries are even now mapping out strategies to increase the conventional construction of new homes to meet housing needs. But these ambitious plans, though well-intentioned, are unrealistic, for they treat housing supply as an independent variable when in fact it depends on the cost and supply of basic resources.

Resources in Perspective

The cost and quality of a home are determined by the type of land it stands on and the materials, labor, financing, and energy that go into building it. Over the last generation, the relative costs of these various components has shifted. (See Table 4.) From 1949 to 1980, the cost of materials as a share of the price of a typical new single-family house in the United States declined slightly, to less than one-third. Land and financing both more than doubled their shares, to nearly one-quarter and one-eighth respectively.

Comparable estimates for developing countries do not exist. However, a study by Jorge Hardoy and David Satterthwaite of the International Institute for Environment and Development found that in 18 Third World nations the cost of building materials represented one-half to two-thirds of the price of a new home, excluding land. Land costs can vary widely, ranging from the exorbitant—such as in some Phil-

Table 4: Cost Components of a New Single-Family House in the United States, 1949 and 1980

Item	1949	1980
	(percent)	
Land	11	23
Materials	36	31
Labor	33	16
Financing	5	12
Profit and Overhead	15	18

Source: Economics Division, National Association of Home Builders.

ippine cities, where they make up an estimated two-thirds of total housing costs—to nearly nothing in some rural areas. On the other hand, financing costs are usually minimal because interest rates on the informal market in the Third World are prohibitively high and few funds are available, so most people borrow very little. Labor costs are also often negligible because construction work is most commonly done by the future occupants and their neighbors.

While the relative costs of the various items that go into building a house are constantly changing, the price of new homes has steadily increased because inflation has affected every element of the residential construction budget. In France, for example, construction materials more than doubled in price between 1970 and 1979. (See Table 5.) During the same period in the United Kingdom, price increases for materials were more moderate but construction wages quadrupled. Compared with other costs, interest rates that affect financing costs have increased slowly in most countries.[31] These figures are deceptive, however, because the price of money and the cost of energy are folded into the price of materials and because financing costs affect land prices, aggravating any increases in the cost of these items.

Society's ability to provide adequate shelter at affordable prices will be determined in part by its capacity to gain some control over the cost of these basic housing resources. A closer look at some of these items—land, materials, energy, and capital—suggests that better management of these resources and alternatives to current building practices will lead to improved housing for everyone.

Table 5: Average Annual Increase in the Cost of Housing Resources and the Consumer Price Index in Selected Countries, 1970-79

Country	Construction Materials	Financing	Labor	Land	Energy	Consumer Price Index
			(percent)			
Canada	8.4	8.0	11.3	13.9*	38.7	7.8
France	9.5	3.6	14.7	19.6**	38.7	9.2
Italy	14.5	4.3	22.7***	n.a.	38.7	13.2
Japan	n.a.	-1.5	14.1	8.2	38.7	9.1
United Kingdom	6.9	9.4	15.7	n.a.	38.7	13.2
United States	9.3	9.5	6.5	6.6	38.7	7.2

*for lots financed under the National Housing Act
**for single-family home plots ***through 1978
Source: Various United Nations and national sources, as detailed in footnote 31.

Land: Doing More With Less

The role land plays in the housing market is defined by the fundamental imbalance between land demand and supply. The supply of land well-suited for housing is inherently inelastic. Higher prices do not necessarily create new supplies of centrally located, well-serviced property. And land, unlike other commodities, is a fixed asset; it cannot be transported from where it is in surplus to where it is scarce. As a result, cheap land in suburban areas only moderately relieves high land prices in the center of cities.

Demand for land, on the other hand, expands exponentially as the result of population growth and rising affluence. Nearly every new family formed would like some land on which to build a home. Those with higher incomes can bid up the price of land and monopolize prime sites with easy access to employment. In addition, the concentration of population in cities and the disproportionate industrial, cultural, and commercial development of metropolitan centers only serves to heighten demand for well-located urban property.

This imbalance between land supply and demand is aggravated by the workings of the marketplace and by public interventions into the

market. Private decisions to withhold land from development as a speculative investment aggravate price rises. Public policies such as zoning and the provision of services, especially transportation, also have significant price impacts. Support services—roads, green space, schools, and so forth—often require as much land as residences do. Finally, the type of housing built also affects land use. Studies in the United Kingdom, Sweden, and Denmark have shown that single-family dwellings require 10 percent more land than semidetached houses do and 20 percent more than multistory residences.[32]

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Total per capita residential land needs can thus be quite high. In U.S. cities with populations over 250,000, everyone has about 82 square meters for residential use, including services. In England, comparable cities on average allocate 116 square meters per capita. Yet large cities with a significant portion of their population in multistory dwellings and cities in the Third World are much denser. London has only 38 square meters per person; Calcutta, 13.6 square meters.[33]

The combined demand of each household's space needs has dramatically pushed up land prices. During the seventies, the average cost of residential land rose by 6.6 percent per year in the United States and by 8.2 percent in Japan, somewhat more slowly than the inflation rate and the increase in the overall cost of housing. These averages, however, mask more dramatic price rises in rapidly growing cities. Land prices in the San Diego area quadrupled between 1975 and 1980, for example; in Tokyo, they rose 18.3 percent in 1980 alone. Few potential homebuyers' incomes have been able to keep pace with these spiraling prices. In Bogota, Colombia, for example, the average annual inflation rate from 1973 to 1977 was about 24 percent, while land prices in squatter settlements went up on average 111 percent a year.[34]

As land prices rise, they constitute a growing portion of housing costs. In 1949, land costs represented one-tenth of the price of an average American house; by 1980, the share had risen to nearly one-quarter. The situation is even worse elsewhere. The cost of land accounts for 30 percent of the price of a home in France and 42 percent of the value of low-income houses in Bogota, Colombia.[35]

The impact of rising land prices is particularly severe in developing countries. The typical price of a legal plot puts it beyond the reach of most households. Thus excluded from the market, people ignore

"In 1949, land costs represented one-tenth of the price of an average American house; by 1980, the share had risen to nearly one-quarter."

the law and set up homes on public or private land or purchase an illegally subdivided lot. This land—in swamps or in ravines with steep slopes—is frequently a dangerous place to build a house. Ne'zahualcoyotl, a large squatter settlement on the outskirts of Mexico City, for example, is on a dry lake bed that often floods after a heavy rain.[36]

Since the most rapid growth in residential land prices takes place on the fringe of urban areas, high prices distort society's use of land. In the American Midwest, for example, the value of land for agricultural use is often less than half its value as a home site. This price differential creates a vortex drawing farmland on the edges of cities into residential use. While to date only a small portion of total farmland has been lost, the impact of these trends on food production is significant, since cities are often set amid prime farm country. A recent U.N. study estimates that if current trends in population growth and residential land use persist, cities to house the projected world population of ten billion will cover the equivalent of half the agricultural land now in use.[37] Consumers will pay for cheaper residential land today with higher food prices tomorrow.

High land prices have already begun to have some effect. In both the United States and France, the typical lot is now actually becoming smaller, reversing a historical trend. In Japan, high land costs have even begun to slow the pace of farmland loss to housing, a silver lining in this otherwise ominous cloud.[38]

Ultimately, spiraling land prices may sever the traditional connection between home- and landownership. A number of American developers have begun experimenting with long-term land leases for homebuyers. Under this scheme, a person buys a house outright but signs a 99-year lease for the land on which it sits. The house can subsequently be sold and resold, but the land is still owned by the developer. For the $85,000 homes being sold with land leases by the Centurion Company of Minneapolis, the difference in mortgage-plus-lease payments has saved homeowners nearly $200 a month.[39] In the sluggish 1980-81 U.S. housing market, land leasing often spurred sales dramatically in the few places it was tried. If property prices continue to rise, this practice could spread rapidly. Public authorities and land trusts could also employ land leasing to control land use without actually taking property off the market. Long-term land leases may even prove useful in resolving tenure problems in squatter settlements, where govern-

ments and private owners may be reluctant to relinquish ultimate control over land but could be willing to rent it to established residents.

Developers in some suburban areas of the United States are also experimenting with house clustering and with "zero lot lines." Higher density development reduces the cost of land per unit. Moreover, it can provide more property for use by the community for parks, schools, and recreational areas. Secondly, placing houses directly on lot boundaries makes a better use of space. In many cities the sprawling, grass-covered American yard, unknown and unaffordable in countries where land prices have always been higher, may be the first victim of the boom in land costs.

Smaller lots and land leasing will not, however, put a cap on rising land costs. As incomes rise and population demands grow, higher prices are inevitable. Indeed, in a dynamic economy, price rises are signals that help society allocate land efficiently. Thus the ultimate objective is not to freeze prices, but to manage them. Land-use planning and zoning are therefore critical. Planned development allows land to be used more efficiently than the fragmented, ad hoc decisions of individual landowners would. In Manila, for example, despite a large population, a 1973 study found that 64 percent of the city's land was undeveloped open space. Such poor planning leads to overcrowding, disproportionately higher land prices in some neighborhoods, and the ungainly sprawl of the city. By comparison, developers who plan their communities have been able to allocate up to 50 percent more space for residential use.[40]

Effective urban land-use planning will often first require a land reform program comparable to that needed in the countryside. In many cities, a small number of people own most of the land. To deal with this problem, India passed a Land Ceiling and Regulation Act in 1976 that set limits on urban landholdings: the larger the city, the lower the ceiling. Unfortunately, this pioneering legislation has been difficult to enforce and has not yet been adopted or fully implemented in most Indian cities.[41]

Some public landownership will often be needed to counterbalance the way the market allocates land. The bureaucratic entanglements of most state ownership, however, argue against highly centralized public landholding, especially when a government is undemocratic and un-

responsive to the needs of the poor. Decentralized public ownership of property through nonprofit neighborhood and community organizations is often more efficient and equitable. Known as land banks, these groups buy, sell, or allocate property to achieve ownership and use patterns that meet community objectives. The largest set of land banks are the Sociétés d'Aménagement Foncier et d'Etablissement Rural in France, which entered the land market to protect farmland from urban sprawl and which now control about one-eighth of all French agricultural land sales.[42] To date, land banks have been used largely by the poor or by public interest groups whose good intentions have been widely acknowledged. Were land banks used by the rich to build exclusive enclaves, they would of course be less politically attractive.

Taxes based on land use are another means of encouraging owners to use their property in a socially beneficial manner. Undeveloped land and abandoned housing are blights on the urban landscape and invitations to illegal squatters. They should be taxed at a high rate. Land with low-income housing, on the other hand, should be taxed at a low rate. Once a country has uniform zoning and records on land values and ownership, a heavy tax can be levied on speculative land transactions. Since Japan initiated such a policy in 1974, speculative sales have nearly disappeared and land price rises have moderated.[43]

A substantial portion of the price of serviced land is the result of public investments in adjoining roads, sewers, water systems, streetcar or subway lines, and so forth. Since this added value is not the result of private investment, there is no reason why landowners should reap the profit. A tax on these unearned increments would discourage speculation and recapture some of the property's value for the community, providing funds for additional public services and new public land acquisitions. A recent World Bank assessment of such a tax in Colombia concluded that it was instrumental in expanding the access of low-income groups to housing.[44] Unfortunately, the record keeping and administration of such taxes is complicated and can initially be difficult to implement in societies without sophisticated systems of public administration.

In the end, however, even the most judicious use of public policy will not solve residential land problems. Demand for land is ultimately a function of population growth, available income, and the type of

housing that developers build and consumers desire. Accommodating this demand to a finite supply of land will determine property costs and the impact of shelter needs on farmland.

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Building Materials, Old and New

In each society, people choose different materials to protect themselves from the elements. In all too many cases, the rich pick costly and often scarce building materials without any attempt to use local construction resources. The poor, on the other hand, frequently rely on traditional materials without trying to improve their quality or to make them more durable. The former is wasteful and the latter leads to low-quality housing.

Lumber is an important component of almost every type of housing. Wood-frame homes have walls, roofs, and sometimes even foundations built with lumber; concrete structures use extensive amounts of wood for frames and joists; and even sod homes often have timbers supporting the roof. Moreover, wood is widely used everywhere for floors and to finish and furnish houses.

Softwood lumber and plywood are the principal types of wood used for housing in the United States. It takes about 1,077 square meters of softwood and 540 square meters of plywood to build an average single-family dwelling. With 1.7 million new housing starts every year, it is little wonder that about 40 percent of the total annual U.S. production of these woods is currently used for homebuilding, making housing the single largest user of lumber in the economy. In Europe, by comparison, the proportion is only 22 percent.[45]

As a result, the demand for lumber tends to reflect the volume of housing construction. Domestic production of softwoods has not, however, kept up with demand and imports are growing. In 1960, the United States imported, principally from Canada, nearly 10 percent of the softwood it used. By 1977, net imports represented 22 percent of consumption and the U.S. Forest Service expects them to remain near that level through the end of the century. European dependence on imported wood is also increasing, from 15.3 percent for 1969 through 1971 to a projected 20 percent by 2000.[46]

According to a U.S. Council on Wage and Price Stability study, "soaring lumber prices have been a recurring problem of increasing severity in every expansion of housing demand since the mid-sixties." While annual price changes have followed a roller-coaster path dictated by the erratic nature of housing starts, over time prices have climbed steadily upward. U.S. softwood lumber and plywood prices have tripled in the last ten years. Similar increases have been seen in other countries. In 1979, British homebuilders paid three times as much as they did in 1970 for imported softwoods. Japanese builders paid more than twice as much for plywood by the end of the seventies.[47]

Rising lumber costs have led homebuilders to substitute cheaper plywood and other wood-based products—such as particle board—for lumber. In the late fifties, for example, half of all new U.S. homes had plywood roof sheathing. By the late seventies, this proportion had risen to more than four-fifths. Metal siding, plastic trim, and nonwood flooring products have also displaced wood. At the same time, more substantial structural changes have been taking place: a growing portion of all homes now have concrete slab foundations and are two stories high, which requires less roofing. As a result, average lumber use per square foot of a finished house in the United States dropped from 8.4 board feet in the early sixties to 6.6 in 1978. Similar construction practices have developed in Europe, where the amount of sawn wood per dwelling decreased by 42 percent between 1950 and 1970.[48]

Competing demands for forest products suggest a grim future for housing lumber supplies. Firewood, paper, and other nonresidential wood needs, combined with the clearing of land for agriculture, have already led to extensive deforestation. At midcentury, roughly one-quarter of the earth's surface was forested. By 1980, the proportion was less than one-fifth. The full impact of this change has only begun to be felt on the global market. The average world export price for coniferous sawn wood rose from $37 per cubic meter in 1961 $118 in 1979.[49] A continued shrinking of timberland could have an explosive impact on lumber prices.

Masonry products, the second principal housing material, first came into widespread residential use in the seventeenth century in Amsterdam, London, and Paris as the result of rising affluence and as a way to prevent the spread of fires in urban areas. Today, cement and

bricks are still the most popular construction material in Europe and Japan. Nearly all new homes in Russia, for example, are built of concrete. And the standard French masonry and steel house has been so successful that its design is now being used in the United States. In the Third World, the use of cement, although still relatively rare, is on the increase, as concrete dwellings have come to represent all that is modern and desirable in housing.

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Portland cement, the type used most widely today, consists of limestone, gypsum, and clay, all of which are ground to a powder and heated to 1,500° Centigrade. It is usually mixed with sand to form mortar, with gravel to form concrete, or with asbestos to form roofing sheets. In 1979, a total of 869 million metric tons of cement were produced worldwide, with per capita consumption ranging from 533 kilograms in Denmark to 27 kilograms in India. Although most Western nations make all their own cement, many developing countries import up to half the amount they use, putting a steady strain on their foreign exchange reserves.[50]

Masonry prices have risen sharply in recent years, with cement prices tripling in both Scandinavia and the United States since 1970. This is principally due to the capital- and energy-intensive nature of cement production. High interest rates make it increasingly expensive to build new cement plants, and oil price rises have meant higher production and transportation costs.[51]

Rising masonry costs are a particular problem in Africa, Asia, and Latin America. In Java, for one, journalist Richard Critchfield reports that there has been a marked shift from bamboo to brick houses. This practice, which is being repeated throughout the Third World, is clearly not affordable. For example, while the average north European worker in the late seventies could buy ten bags of cement with a day's wages, a rural African needed to work ten days to buy just one bag of cement. Tanzanian President Nyerere has called the widespread addiction to cement and tin roofs a kind of mental paralysis that impedes improvements in housing quality by absorbing vitally needed capital. Moreover, concrete houses are often unsuited to tropical climates. Algerian architect Kamel Noui-Mehedi recounts the lesson learned by one peasant family that bought a concrete house: "Only a few months sufficed for the humidity to cause the whole family to flee from their

"In many parts of the world, adapting traditional housing materials to modern needs will hold down individual and national housing costs."

home. Today, that family is living in a house with a thatch roof and is keeping its cattle in the concrete house."[52]

Growing competition for lumber, the problems of deforestation, and the rising energy costs of concrete underline the importance of finding alternatives to these widely used building materials. Throughout history, most people have lived in shelters of grass, bamboo, stone, cloth, or animal skins. Even today the Chinese characters for "building" translate as "a great enterprise of earth and wood."[53] In many parts of the world, adapting these traditional housing materials to modern needs will hold down individual and national housing costs and improve housing quality.

The most basic of traditional materials is earth. Over half the people in the developing world now live in buildings that are at least partially made of mud and they will probably continue to do so for the foreseeable future. Navajo adobe homes built in the American Southwest at the time of the Spanish conquistadores are still standing. Recently, there has been a revival of American interest in this earthen construction. An estimated 175,000 adobe houses exist in the United States today and the number is growing.[54]

Earth is a universally available, inexpensive building material that is easy to work with and aesthetically pleasing. Unfortunately, it is also easily eroded by water and tends to pull apart, so it is a poor material for roofing or for framing doors and windows. To compensate for some of these drawbacks, homebuilders in many parts of the world plaster the earth with dung or straw to weatherize it. Since Biblical times people have mixed straw with mud to give it more stability. Now builders have found that adding a small amount of cement significantly strengthens earth bricks and increases their insulating capacity without dramatically increasing cost. And by mixing in about 2 percent asphalt they have created a hybrid called "asfadobe," a water-resistant brick. Building a mud house with a large overhanging roof and a stone base for the walls further accommodates mud's shortcomings by making it less susceptible to rain and ground damp. Finally, the load-bearing capacity of earth can be increased severalfold by pounding it together into "rammed earth" or by compressing it into solid bricks in a simple device called the Cinva Ram.

Lower cost is a principal advantage of using traditional materials. In the Sudan, for example, cement blocks cost $60 to $96 per thousand and regular bricks, $20 to $32 per thousand. By contrast, asfadobe bricks can be produced for no more than $12 per thousand. A second benefit of using traditional materials is the generation of much-needed employment in developing countries, since building an earthen house is labor-intensive. And because mud and thatch are readily accessible, their use creates opportunities for the poorest households to construct and repair their own homes. Finally, many Third World countries now import three-fifths of the materials used in official construction, accounting for 5 to 8 percent of the value of their national imports. Use of traditional, locally available materials can reduce this drain on foreign exchange.[55]

The main obstacle to a greater use of traditional materials is the status now associated with living in a home built with "modern" materials. To most people, mud and thatch houses are linked with poverty. Moreover, a concrete house is an investment that often increases in value faster than inflation, whereas a home of traditional materials is expected to crumble and decay with time. Improvements in the construction properties of traditional materials could increase their appeal to homebuilders. Ultimately, however, people will stop wanting to live in concrete houses only when they see the rich using traditional materials for their own homes.

There are some encouraging signs of such a return to traditional building materials. Major oil companies are investigating the market potential of asfadobe. The Cinva Ram, first developed in Latin America, is now being marketed in several African countries. And some builders in California have begun using asfadobe and rammed earth to construct prize-winning homes that typically cost one-third less than the average new home on the market.[56]

Unfortunately, many obstacles to a wider use of traditional building materials remain. They are not now part of the market economy. There is no industry, therefore, with a vested interest in encouraging and upgrading their use. Construction codes appropriate for brick, lumber, or glass inhibit the employment of traditional materials. For example, U.S. Department of Housing and Urban Development regulations require adobe to conform to insulation standards set for cement

and wood, which adds as much as $20,000 per unit to the cost of using adobe in public housing.[57]

Mud and thatch will never replace wood and concrete as the preferred housing materials in North America or Western Europe. Nor will they be appropriate for building high-rise offices in the Third World. But traditional materials have a bright future throughout the world in the construction of homes for low-income people and in building houses designed to require little energy to build and to heat or cool.

Better management of the supply of all types of housing materials will moderate the impact of rising costs on housing prices. In North American forests, a better use of waste wood and an aggressive reforestation strategy would increase lumber supplies for both the domestic and the international market. In the Third World, the creation of village woodlots and the planting of fast-growing trees would provide timber for the roof beams and wall stays needed even in mud construction, while increasing much-needed fuelwood supplies. The development of composite paneling that used adhesives not based on petroleum would cut costs, increase the use of waste wood, and reduce the competition for available lumber.

The U.S. construction industry now consumes 6.5 billion pounds of plastic each year. Materials experts think this could be increased severalfold by the end of the century, cutting back on the use of wood and metals and saving energy, for plastic building materials embody significantly less energy than steel or aluminum do. In addition, since engineered plastics and plastic reinforcements are often stronger and lighter than other materials, their use would reduce shipping costs and the amount of materials consumed in the building of superstructures.[58]

Similar savings are possible in the production of cement. Less energy-intensive means of producing it cut masonry costs substantially. The United States and the USSR lag well behind Western Europe and Japan in developing energy-efficient plants. Many Third World governments persist in building huge cement plants to service large areas. Yet small, decentralized plants near construction sites would cut transportation costs that now price cement out of the reach of many low-income homebuilders.

Designing houses with an eye to reducing materials use will be one of the architectural challenges of the eighties. Finding a way to support a roof with less material or designing an attractive wall without using expensive finishings may not be as exciting as building an all-glass skyscraper. But it is certainly more socially useful. Building more row houses or low-rise multifamily dwellings will save materials by sharing walls and roofing, while helping to create new patterns of community life.

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Finally, research into traditional and alternative building materials has only just started. Recent studies indicate that refuse paper can be converted into roofing material and that waste sulfur is ideal for building blocks. Waste products from industrial sites and junkyards have always been a source of building materials for the poor, but their use has always been haphazard. There has never been a systematic assessment of waste products to find the most appropriate one for each building task. Moreover, homebuilders have just begun to explore the insulating properties and the aesthetic appeal of earth and stone and their appropriateness in Europe and North America. The potential cost reductions, labor needs, and environmental implications of a greater use of traditional materials are not yet well understood. Research done by the Intermediate Technology Development Group in England and work funded by Appropriate Technology International in the United States are important first steps in this investigation. But to have some real impact on the choice of construction materials and techniques around the world, dozens of similar appropriate housing technology projects are needed so that practices and innovations in one area can be transferred easily to others.

Building designs and material needs are now defined by architectural styles and construction techniques that developed during an era of plentiful resources and cheap energy. Modern architects and homebuilders must realize those days will never return. They have much to learn from traditional builders who never had the luxury of building in a resource-intensive manner.

Energy: A Two-Dimensional Challenge

Houses consume energy both in their construction and in their day-to-day use. The dramatic escalation in the price of energy in the

seventies will shape the type of dwellings built, the materials and construction techniques used, and the amount of home renovation in the decades ahead.

Residential construction accounts for about 2 percent of overall U.S. energy consumption—including the energy used directly in building and that embodied in construction materials as a result of their mining, harvesting, or manufacture, their finishing, and their transportation. By comparison, the energy used to light, heat, cool, and ventilate buildings accounts for roughly one-third of U.S. energy consumption.[59] Recent public discussions of residential energy use have rightly focused on day-to-day consumption because the opportunities for savings are both apparent and significant. Yet there is additional room for energy savings in construction.

A homebuilder's choice of materials has significant energy implications both immediately and in the long run. Softwood products embody 7,700 BTUs per board foot on average, while plywood uses an average of 9,300 BTUs per square foot. Portland cement, by comparison, embodies roughly 1.6 million BTUs per barrel. Building a house involves a large investment of energy in construction materials no matter what is used. However, using slightly more energy in the initial construction can sometimes save energy over the lifetime of the building by requiring less operating energy. For example, a study by energy analyst Bruce Hannon and architect Richard Stein indicates that after 15 years of use, a brick-veneered wall with 3.5 inches of insulation will use about 40 percent less total energy than a shingle wall with no insulation. On a more basic level, an adobe house not only uses less nonrenewable energy to build than a concrete structure but, because of earth's natural insulation properties, requires less energy over time to heat.[60]

The energy embodied in building materials helps determine their cost. Rising fuel costs now represent between one-third and one-half of basic cement production expenses. In the Soviet Union, the outdated wet manufacturing process that is still popular requires one-quarter to one-third more energy than the more efficient dry process, resulting in even higher costs. Moreover, the energy costs of transporting cement are becoming prohibitive. In many Third World nations, the price of gasoline and diesel fuel double the cost of any cement transported more than 200 miles.[61] The plans of the Soviet Union and

of many Third World governments to improve the quality of their shelter by building more cement homes contain hidden energy costs that could bankrupt their projects.

The implications of higher energy costs for building materials are already becoming apparent in many countries. In Nigeria, which imports 45 percent of its cement, half the foreign exchange spent on these imports pays for the energy embodied in the product—an ironic position for an OPEC member. And in Denmark, which makes most of its own cement, the industry accounts for about 2 percent of the country's energy bill.[62]

Over time, the amount of energy needed in residential construction will increasingly define the type of homes built. The most energy-intensive units built in the United States are high-rise apartments, which consume an average of 740,000 BTUs per square foot of floor space, largely because of the amount of structural steel and concrete they require. (See Table 6.) Single-family homes use only slightly less energy. Because of shared walls and a common roof, the most energy-efficient homes to build are two- to four-unit dwellings, which require only 630,000 BTUs per square foot. Homebuilders in other countries face similar energy trade-offs. A typical Canadian wood-frame house requires about one-third less energy to build than a home of concrete or steel. Further, if the builder decides to put in a treated wood basement instead of a concrete one, less than half as much energy is used overall.[63]

Table 6: Energy Use In Various Types of Housing

Type of Home	Energy Used In Construction	Energy Used Annually
	(thousand BTUs per square foot)	
High-Rise Apartment	740	50.6
Single-Family House	700	76.5 to 82.6
Townhouse	n.a.	68.9
Garden Apartment	650	n.a.
Low-Rise Apartment	n.a.	51.2
Two-to-Four-Family House	630	n.a.

Source: Bruce Hannon *et al.*; Dale L. Keyes.

"A survey in the early seventies found that households in multifamily structures used at least one-third less energy than single-family dwellings did."

Because different types of units require varying amounts of energy to light, heat, cool, and ventilate, lifetime energy costs will also shape housing patterns. A survey in the early seventies by the Washington, D.C., Center for Metropolitan Studies found that in units of the same size, households in multifamily structures used at least one-third less energy than single-family dwellings did. And since most apartments are smaller than houses, the actual savings are often greater. These gains are primarily due to the inherent thermal insulation advantages of common walls. However, beyond a certain height, usually ten floors, any gains in energy efficiency by individual units are offset and eventually overwhelmed by the energy required to maintain a building's common services, such as elevators.[64]

Homebuilders are only beginning to think about lifetime energy use as a construction criteria. James Barron of the New York State Energy Research and Development Authority observes: "The home-building industry is where the American automobile industry was a couple years ago: making energy hogs and unable to sell them. Homebuilders are just lucky that Japan doesn't export houses."[65]

Fortunately, consumers seem to be several steps ahead of builders. Townhouses and condominiums are selling well in Europe and North America. In a survey of 1,400 U.S. homebuyers in the late seventies, three out of five people said the energy-saving features of their new houses influenced their decisions. Even more people said that they thought energy conservation would affect their next home purchase and a majority of those surveyed said they would be willing to pay more to get an energy-efficient home. According to Paul Rappaport of Temple University, who interpreted the survey for the National Association of Home Builders, the level of energy efficiency in a house and the builder's reputation as a quality builder are becoming linked in the buyer's mind.[66] Just as appliances now carry labels noting their energy consumption, it may not be long before house advertisements tout low lifetime energy use.

The massive amounts of energy needed for new construction are a convincing argument for greater housing rehabilitation. Recycling old buildings saves energy in two ways: first, the use of existing walls and internal structure reduces the amount of materials, and thus energy, needed to create a livable space; second, rehabilitation often relies on building materials that require less energy to perform a

given function. As Richard Stein points out in *Architecture and Energy*, there is much less energy embodied in the materials used in alterations than in those used in building new dwellings. As a result, the energy used per square foot in rehabilitation may be only half that of new construction. In addition, older buildings were often designed to be compatible with their environment and to be naturally heated and cooled, and they can be rehabilitated to rely on many of these important solar properties, thus reducing their lifetime dependence on nonrenewable fuels.[67]

The housing industry has only begun to turn to the task of building—from scratch or through renovation—energy-saving, climate-sensitive structures that are well-insulated and oriented toward the sun to take advantage of natural cooling and heating. No more than 20,000 passive solar homes stand in the United States, and only about a quarter of the nation's housing stock has been retrofitted with attic insulation. Even these meager accomplishments dwarf those in most other countries. Ultimately, the greatest residential energy savings will be achieved with new designs using low-energy materials to build relatively small, low-rise multifamily structures that warm themselves with the sun's heat and cool themselves with the evening's breezes. Such energy-attentive design could cut energy use in new buildings by 75 percent.[68]

When oil cost $2 a barrel, the lifetime energy use of a house was of little concern to builders or buyers. With petroleum now priced between $30 and $40 a barrel and with every expectation that it will go even higher, housing energy considerations take on a whole new meaning. Moreover, the houses built in the early eighties will still be standing when world petroleum production begins to decline by the turn of the century. The building materials and housing designs chosen today will help determine how fast society consumes that vanishing resource.

Financing Shelter Needs

The amount of money a nation invests in shelter is probably the best single indicator of the quality of its housing. In 1978, Asian, African, and Latin American investment in housing ranged from 1.5 to 5.5 percent of gross domestic product, while it was 7.5 percent in Japan, 6.2 percent in West Germany, and 5.2 percent in the United

States. This pattern is not surprising. At very low levels of income, survival needs such as food absorb the lion's share of a nation's investment. But as incomes rise society has more money to invest in shelter. Ultimately, however, as population growth and urbanization slow and the quality and quantity of housing reach a certain level, the share of its wealth a nation devotes to shelter can taper off.[69]

The prevailing cost of money affects housing prospects in two discrete ways. Homebuilders—be they commercial contractors, governments, or people building their own houses—must borrow money for construction. The short-term interest rates they pay help determine the supply of housing and its sales price or rent. Homebuyers, in turn, must borrow money to pay for a house. The interest on this mortgage is often the main component of a family's monthly housing costs.

In most market economies, the cost of money is determined by the interest rate that banks charge their best customers, known in the United States as the prime interest rate. The "prime," in turn, depends on what banks must pay to attract funds in the open market. In noninflationary times, lenders charge low interest rates—traditionally from 2 to 3 percent per year—because the value of their loan does not erode over time. But in an inflationary period, lenders require a higher premium to part with their money because they will ultimately be repaid in devalued currency.

The U.S. prime interest rate was relatively stable throughout the sixties, but then began a roller-coaster ride that reached record-breaking heights by 1981. Rates that averaged 4 to 5 percent for a decade rose to 10.8 percent in 1974, dropped back for a few years, then soared to 20 percent in 1981 as the government attempted to curb the growth in the money supply by raising its cost. There was a similar rapid increase in the French prime rate, which by mid-1981 stood at 20.6 percent. The cost of money rose more slowly in West Germany, to 14.5 percent, and actually declined slightly in Japan, to 6.75 percent. The prime is less important in Third World countries, which in effect operate with two interest rates—one set by the central bank and one charged by traditional village moneylenders. In the mid-seventies in the Sudan, for example, the official lending rate was 10 to 12 percent, but the unofficial rate was 50 to 100 percent.[70]

The impact of the money market on the housing industry varies from country to country. Socialist governments, as the primary builders of housing in their countries, absorb the cost of money in order to keep rents and home prices low. The profits of state-run businesses foot the bill. In the poorer countries of Africa, Asia, and Latin America, where most homebuilders rely on the unofficial money market, usurious short-term interest rates ensure that few people borrow to build. The effect is therefore an indirect one, through higher prices for materials. In market economies, however, the cost of money often sets the pace of homebuilding.

A typical American builder must borrow money for six to seven months at an interest rate about 2 percentage points above the prime. Thus contractors' decisions to build homes are acutely sensitive to the prevailing cost of money. In 1972, when the interest rate was 5.25 percent, ground was broken for a record 2.4 million homes. In late 1980 and early 1981, when the prime reached unprecedented heights, housing starts slowed dramatically, with serious employment repercussions in construction and related businesses.[71] The reason was the carrying cost of money. In 1972, borrowing $10 million cost $44,000 a month in interest. In 1981, it cost $167,000 per month.

The short-term capital obligations of homebuilders contrast with the long-term capital commitments of homebuyers. When people purchase a home, their income must be sufficient to meet monthly mortgage payments for years on end and they must have a reasonable assurance that they may one day sell the house for enough money to pay the remainder of their original loan. Today, the cost of home mortgages in the United States is undermining people's ability to make such forward obligations with any degree of confidence.

During the late seventies and early eighties, U.S. home mortgage rates followed the volatile course traced by the prime, rising from 7.5 percent in the late sixties to a record high of 16 to 18 percent in mid-1981. As a result, average mortgage payments doubled without a comparable increase in average income. The traditional rule of thumb that a family should commit no more than one-quarter of its income to housing went by the board. One-third is a more accurate yardstick today and some homebuyers pay much more. In early 1981, one effect of this burden could be seen in a disquieting rise in the number of delinquent mortgages.[72]

"Given the capital needs over the next generation, it is doubtful whether the high levels of housing investment in North America and Japan should continue."

The deceptively simple solution to the high cost of money for homebuyers and builders is to lower interest rates. Yet in the United States, this would sabotage the government's efforts to gain some control over the money supply. Moreover, although lower mortgage rates would increase the demand for housing, most new financing in recent years has been used to buy existing structures, which has inflated prices without significantly adding to the total housing supply. Most importantly, lower interest rates would increase the amount of money flowing into construction and related industries just when Western economies have been accused of overinvesting in the housing sector.

As Anthony Downs of Brookings Institution has pointed out, the fraction of capital raised by the nonfinancial sectors of the U.S. economy that went into home mortgages rose from 14.3 percent in 1970 to 27.9 percent in 1979. During the seventies, Americans put more money into home mortgages than into corporate bonds and commercial and industrial mortgages combined. Investment in the residential sector as a percentage of gross domestic product has increased similarly in Japan and Canada over the last 15 years, with no sign of declining, which would be in keeping with historical trends.[7]

Since people in industrial societies already live in the world's biggest, most well-appointed houses, they should be investing less, not more, in housing. Given the capital needs over the next generation for reindustrialization, the maintenance of social services, and environmental safeguards, it is doubtful whether the high levels of housing investment in North America and Japan should continue. Most economies might be better served following the lead of the West Germans, who are slowly decreasing investment in housing. This would permit a redirection of capital investment towards more productive or socially beneficial ends, while moderating price increases.

The high interest rates in 1980 and 1981 have in fact begun to shift investment patterns. But this approach amounts to attacking the problem with a blunderbuss when a rapier would be more appropriate. High interest rates choke off the money that would go into housing, both as an investment and to meet even moderate household formation needs. When interest rates are high, builders become wary of finding buyers and they cut back on construction. And even if both parties become accustomed to new interest rates, the increased capital costs of building and borrowing will mean higher prices and higher

monthly mortgage payments, further reducing the number of people who can afford to buy a new home. Redirecting investment without stifling the housing industry requires a three-pronged capital policy for housing: new sources of funds for homebuilders, new savings incentives for homebuyers, and a change in tax incentives for homeowners.

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Homebuilders will need an unprecedented amount of money in the eighties. Pension funds and similar pools of capital controlled by groups interested in affordable housing are one potential source. In West Germany, more than one million people already live in homes built with money controlled by unions. In return for the use of their money, such special interest groups can influence homebuilding decisions. In the Emmertsgrund in Heidelberg, for example, a certain portion of the 3,000-unit development is specifically set aside for low-income people. Groups lending builders money could apply the same concept to rental housing, energy-efficient homes, or whatever a particular area's housing needs might be.[74]

While homebuilders need new sources of funds, homebuyers in the United States need to borrow less and save more. In the speculative housing market of the seventies, for example, Americans abandoned all pretense of saving to buy a home. They bought first, on huge amounts of credit, and saved later through building up equity in their homes. This equity—greater than all personal savings in the United States—was tied up and largely unavailable for productive investment, a situation that contrasts sharply with savings patterns in most industrial countries. In 1979, for example, while Americans saved just 5.6 percent of their disposable income, West Germans saved 14.5 percent and Japanese put aside 20.1 percent of theirs.[75] Since the West Germans and Japanese saved through bank accounts, their money could be used by others to create jobs and finance economic growth.

West German savings habits are in part due to the *bausparkasse* savings institutions, which account for more than half of the country's housing finance. *Bausparkassen* lend money to prospective homebuyers through savings contracts. Depositors agree to put aside a specified amount at a low interest rate in return for a future mortgage commitment at a guaranteed rate of interest, which in the late seventies was 4.5 to 5.0 percent. The person who sets aside the largest sum over the shortest time has the highest priority for a loan. In

"The declining number of people per housing unit in the United States is not so much an improvement in housing quality as it is a misallocation of housing resources."

addition, various government incentives—premiums over and above the interest rate—mean a total return on a saver's funds of up to 28 percent per year tax-free, providing a huge inducement for people to save to buy their own house.[76] Similar programs in the United States, or possibly greater use of tax-free savings certificates issued by banks or savings-and-loans associations, would deflate the speculative housing market by channeling money into savings and would slow housing investment in general by encouraging prospective homebuyers to save money. At the same time, lending institutions would have adequate mortgage funds to meet new housing needs.

The third provision of a new capital policy involves reducing the current tax incentives for people to invest in housing. In the recent inflationary climate in the United States, low interest rates coupled with tax deductions for mortgage payments have led to a record demand for housing. For a homeowner in the 40 percent bracket, for example, the after-tax interest rate on a 1979 mortgage of 10 percent was 6 percent. Since inflation meant the money the homeowner paid out monthly was declining in value by at least 10 percent a year, the real interest rate was minus 4 percent. Moreover, Americans do not pay taxes on the profits they make as investors by renting their homes to themselves. Under these circumstances, it is little wonder that housing demand was stimulated far in excess of any potential to increase supply, driving up prices for new and existing homes.

James Poterba of the National Bureau of Economic Research concludes that the combination of homeowner tax deductions and inflation could be responsible for as much as a 30 percent increase in housing prices in recent years.[77] Moreover, interest deductions encourage people to buy more housing than they really need. It is not uncommon in the United States for childless couples to buy three- and four-bedroom houses solely because of the tax advantages. Seen in this light, the declining number of people per housing unit in the United States is not so much an improvement in housing quality as it is a misallocation of housing resources.

In general, tax subsidies are socially useful if they stimulate greater supply, such as the mineral depletion allowance or investment tax credits for industry. But the deduction for mortgages stimulates demand. Since two out of three American voters benefit from homeownership subsidies, it will be politically impossible to eliminate them

totally. However, the Urban Institute rightly points out that replacing tax deductions with a uniform tax credit, like those already used in some nations, would most benefit low- and middle-income households and would eliminate the tax advantages of buying ever more expensive housing.[78]

While industrial countries attempt to scale down their investment in housing, the nations of Asia, Africa, and Latin America face an entirely different problem—a scarcity of capital for housing. The rate of housing investment in developing societies is uniformly low because of the acute competition for available funds. Since financial resources are so scarce, industrial and agricultural investments take precedence over those in shelter. Yet in even the poorest economies housing investments could be increased by systematically mobilizing people's savings.

Most people in developing countries cannot afford to borrow money from a bank or savings institution. They simply draw on their own disposable income or borrow from relatives to buy building materials or to pay contractors to lay a foundation. This practice necessarily limits investment and forces people to build their homes in stages, as they can afford to buy a few more bricks or pieces of tin roofing. It contributes to higher overall housing costs because individuals miss the cost savings of buying in bulk. Moreover, improving the quality of housing becomes more difficult because major investments in water and electricity lines and in sewage facilities are almost impossible with piecemeal borrowing.

Some credit institutions do exist in the Third World, however, generally made up of relatives, friends, or members of a community or neighborhood who know each other. In these rotating credit societies, people contribute a predetermined amount of money to a pool of funds on a weekly or monthly basis. In many parts of Asia, each member has a right to bid for the funds in the pool. The highest bidder wins the pool and is obligated eventually to repay the amount bid, in essence the equivalent of repaying principal and interest. A recent study in Korea found that two-thirds of all households in Seoul belonged to such savings societies through which they saved on average 7 percent of their income.[79]

The principal shortcoming of these rotating credit systems is that they fail to mobilize a great deal of capital or to realize the economies of scale that would allow wider access to funds and increased extensions of credit. A more structured relationship among informal-sector financial organizations, as well as between them and formal financial institutions, would extend these savings benefits to more people. For example, in many Third World cities migrants send money back to their families in the villages. A system has developed in South Africa that broadens the impact of these funds: migrants from the same village pool their resources to provide financing for building better housing back home. Such new financial institutions hold great promise, but they must be developed cautiously to ensure that they remain in the control of their poorest depositors. Otherwise, capital could be drawn out of poor communities and be used to build homes for the wealthy.[80]

The cost and availability of capital is probably the most pressing housing resource issue in the early eighties. Interest rates in industrial countries and on the informal market in developing economies must drop if efforts to moderate shelter costs and to provide more and better housing are to succeed. Higher rates of savings and new savings mechanisms for consumers are part of the answer. But also essential are the conscious public policies that limit housing investment and that redirect it into the types of housing most needed by society.

The Home of the Future

The French historian Fernand Braudel has observed that "a house is built or rebuilt according to traditional patterns. Here more than anywhere else the strength of precedent makes itself felt."[81] Over the last three decades, people have broken with the housing patterns of the past. First in rich countries, and then increasingly among the poor, people have built homes that make extensive use of basic nonrenewable resources. Rapid population growth, tightening economic conditions, and resource scarcities have now made these new styles unacceptable. Of necessity, the house of the future will be built with an eye toward economies of space and materials.

The very cost of a new home is probably the most telling indicator of the need for change. If recent trends continue, the median price

of a new house in the US will range from $130,000 to $156,000 by 1990. In some European and Japanese cities, prices will increase even faster. The price of a commercially constructed home in Africa, Asia, and Latin America, now roughly four times the cost of a traditional home, could double.[82] Increasingly, only people who already have amassed equity in a house will be able to afford to buy a new one.

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As prices ride up this cost curve, more and more homebuyers will be unable to devote an ever greater portion of their income to housing. At projected price levels, it will not be uncommon for people to spend up to half their incomes on shelter. Those in subsidized housing can expect to be spending as much of their income as homeowners do today. Even the poor who crowd squatter settlements around the world may spend more of their meager incomes on shelter, squeezing budgets that have little flexibility to begin with. Although its level is not yet clear, a practical ceiling will soon be reached on the portion of a family's income that can be spent on housing without basic health care or adequate nutrition being sacrificed. Experience in the Third World indicates families will forgo improvements in housing quality before cutting back on other basic expenses.

Current housing cost projections cannot fail to affect the European, North American, and Japanese housing markets. Builders will respond to the price spiral by building modest, no-frills homes. "We have to go back to basics," Thomas Garafalo, a Connecticut homebuilder, told the *New York Times* in early 1981. "We've all been so spoiled, but you've got to cut down if people are going to be able to buy a home."[83]

The first victim of resource constraints may be the size of building lots. The average size of a finished residential lot in the United States peaked in 1979 at 1,189 square meters, signaling the beginning of a slow contraction in lot size. Over time, individual yards and gardens may give way to common space, to reduce land costs. Village Homes, a 200-household development in Davis, California, for example, is built in clusters of eight to ten homes each, with no front lawns and shared backyards that are maintained by the community and that include vegetable gardens, fruit trees, and playing areas. Planning land use in this way has done more than save money. "By eliminating the small front lawns," says Mike Corbett, the community's developer, "we were able to use that acreage collectively. . . . We now have twelve

"The single-family house is a peculiar development based on cheap capital, energy, land, and materials."

acres (out of 77) in agricultural production." Clustering has also cut down on heating and cooling costs and has conserved energy and materials needed for roads and parking areas.[84]

The price and scarcity of land and other resources will inevitably lead to higher-density urban living in industrial countries. The single-family house is a peculiar development based on cheap capital, energy, land, and materials. Recent pressures on each of these resources are forcing new housing patterns, with a growing proportion of the population living in townhouses and small, multifamily dwellings. These units take less energy to build and maintain and they conserve land and materials. Moreover, they match well with the demand for housing that is now emerging. The many unmarried individuals and retirees looking for smaller, low-cost, low-maintenance homes create a natural market for attached houses and for "fourplexes" and "sixplexes"—essentially large houses divided into four or six separate units.

The house of the eighties, like the car of the late seventies, will be downsized to conserve resources. A typical new American home may contain less than 130 square meters (1,400 square feet) of finished living space, a return to the size of homes in the sixties. The average multifamily unit will also become smaller. European single-family homes, which already average less than half the size of American ones, may continue to get larger but probably at a slower rate, as the single-family housing market peaks and smaller, multifamily units regain a larger share of the market. As is already common in parts of Europe, many homes will be sold with one or more unfinished rooms, which allows people to buy a less expensive house and to complete it when they can afford to or have the time to do the construction work themselves. The sale of smaller houses to young couples will inevitably lead to more home alterations—already a $54-billion-a-year business in the United States—as people add rooms when they have children. In addition, more and more people will live in renovated older homes. An increasing amount of this renovation will be do-it-yourself work, allowing people to both save money and be more creative with their living space.

Inside the home, less total space will require interiors to be redesigned. Architects face the challenge of creating a spacious feeling while working with a smaller area. By using open space creatively, the total number of rooms can be reduced. Americans who could afford a

separate dining room when housing cost $40 a square foot may no longer want one in 1990 when it could cost more than $80 per square foot. Most new homes will have one bathroom, smaller kitchens with fewer energy-consuming appliances, and more compact bedrooms with built-in furniture, cabinets, and closets. Southfacing walls will have more windows, which can provide a sense of roominess while acting as passive solar collectors.

The traditional Japanese house serves as a model of how the home of the future can take account of resource constraints without sacrificing housing quality. There is little functional differentiation between the main areas of the classic Japanese home. Sliding panels take the place of interior walls, allowing rooms to be quickly separated or connected. A room used for sleeping at night is easily transformed into a dining area or entertainment room during the day. Furniture is kept to a minimum and often serves several purposes. The Japanese practice of making do with less will become common in many cultures in the future.

Just as some neighborhoods begin to share outdoor space to cut down on individual lot size, households in industrial countries could begin to share living space. Housing units with two or three master bedrooms but with a common kitchen and living area—called "mingles" units—will become more popular, giving unrelated individuals the opportunity to own a home at an affordable price while maintaining a measure of privacy not available in a communal arrangement. The elderly and couples with grown children who have left home may find this a particularly attractive way to avoid the isolation of impersonal apartment complexes or institutional care.

Large houses are increasingly being divided into several units and the basements of single-family dwellings are being turned into apartments—trends that are likely to accelerate as space constraints become a bigger problem. William C. Baer of the University of Southern California estimates that over half the housing units in the United States have surplus space, which he defines as more than two rooms per person. As many as 1.7 million new housing units could be created with this excess, roughly the equivalent of one year's supply of new housing.[85]

Rising energy costs for transportation over the next few decades will mean more people will consider working out of their homes, much as people did until the eighteenth century. A number of communities have already begun to change their zoning laws to permit home-based offices and cottage industries. Development of home computers and other information technologies will permit more white-collar work to be done at home. Thus although houses will be smaller they will have new demands placed on their space, requiring office nooks and basement workshops in some cases. The home of the future in industrial countries could thus have a different role as well as a different shape.

In the Third World, where the housing problem is so severe, resource scarcities will do even more to shape the home of the future. For the majority of households that already lack both space and basic amenities, these constraints will make it quite difficult to improve housing conditions and will severely curtail housing aspirations.

If population growth continues at a rapid pace, housing density will increase. Lots will have to be subdivided into smaller and smaller parcels. World Bank reports indicate that this has already begun in the squatter settlements in places such as Bogota, for example.[86] Land pressures will force more people to build homes on marginal land, perched on precarious slopes above Rio de Janeiro or nestled among the tombstones in the "City of the Dead" in Cairo. Illegal land occupations will become more common. The injustice of leaving large tracts of land undeveloped in the heart of burgeoning Third World cities may well ignite new political unrest. Future squatter settlement houses and rural dwellings could not be much smaller than they are today, but they may be even more crowded. The typical family already often has six children living in a space probably suitable for two. If birth rates continue at present levels, there is little hope of improving these conditions.

The homes of the poor will undoubtedly continue to lack water, sewage disposal, and electricity. In many poorer areas, providing each house with these services costs as much as one-third of the value of individual dwellings.[87] Although many families could afford monthly service charges for basic necessities, unless governments pay the installation costs most people will have to continue buying their water from vendors and using roadside ditches as toilets. The difficulty of mounting massive new public-works projects and the health and en-

vironmental costs of not doing so underline the need for alternative public services, including such resource-conserving technologies as simple waterless toilets and wind-generated electricity. Already, simple designs for these systems have emerged that are both efficient and cost-effective. However, they have not been tested widely and need to be adapted to different village cultures.

People in the Third World have traditionally relied more on public space than those in industrial nations. As cramped housing conditions are likely to continue for some time, this tradition could prove advantageous, especially as governments begin to work with squatter settlements to plan their development. Neighborhood centers and public squares could provide opportunities for socializing, for watching television and listening to the radio, and for community meetings. In cultures where they are acceptable, shared public baths and laundry facilities could make up for the lack of individual accommodations. They could also encourage a frugal use of resources and facilitate the recyling of water and waste materials.

Given the cost and the difficulty of obtaining cement, steel, and commercial grades of lumber, people will continue to live in dwellings made of traditional and scrap materials. However, these houses need not be hovels of crumbling earthen walls and rotting straw roofs. Reinforced earth can be used instead of mud, and new pressed-fiber roofing materials can replace thatch and the costly tin roof. The resurrection of traditional architecture emphasizing vaulted ceilings and other important resource-conserving techniques will improve the quality of Third World housing at a cost people can afford.

The typical home in Africa, Asia, and Latin America will continue to be built by the people who want to live in it. Rising costs have forever dashed any hopes that commercial builders or the government could supplant self-help and mutual aid. Projects to upgrade squatter settlements and to provide people with a housing site and a few basic public services, which were initiated by the U.S. Agency for International Development (AID) and the World Bank and are now carried on by a number of governments, will be the primary organized housing activity in many countries. But even these efforts will be overwhelmed by the demand.

A picture of the house of the future is only starting to come into focus. In North America, Japan, and Western Europe, recent trends in resource use are clearly unsustainable. People's homes must be more in tune with the constraints imposed by the environment and the economy. And in the Third World, improvements in housing cannot follow the resource-intensive Western model. Instead, traditional building techniques, more appropriate for the incomes and resource constraints faced by poor households, must provide the basis for any improvement in the quality of life in even the poorest of homes.

Housing Policies in an Era of Limits

Housing is one of the most public of issues. The quality and the price of housing have a telling effect on people's well-being. Governments clearly have a role to play in improving shelter conditions. Yet the magnitude of the housing need in the Third World and the inordinate cost of housing in most industrial countries dwarf available government resources and make it impossible to shelter with public assistance all those who lack decent housing. With even the small budgets used by the World Bank for their basic sites-and-services projects, sheltering the 100 million poorest households in Africa, Asia, and Latin America would cost more than $60 billion. This is triple the total amount of foreign aid from all sources for all purposes in any given year. And in the United States, constructing and maintaining a single public housing unit over the expected 40-year life of the building is projected to cost nearly $500,000.[48] At these prices, it is difficult to justify concentrating public expenditures on housing while other basic needs—nutrition, health care, and energy—also go unmet. Moreover, at a time when government's role in helping satisfy human needs is being reevaluated in many countries, the political will to solve housing problems by increasing taxes and transferring resources from the rich to the poor often does not exist.

At the most basic level, the role of government is also limited by the fact that housing patterns evolve out of millions of discrete choices by individuals. Every family has different shelter requirements and each knows best what it can afford to spend on housing. This highly disaggregated system does not lend itself to centralization. All too often where public housing has been tried on a massive scale, basic shelter needs have been met but at a cost to the quality of life. The Grand

Ensembles on the outskirts of Paris and the blocks of grim government-built high rises that ring Moscow, Leningrad, and Kiev—badly constructed and largely devoid of supporting services—are testimony to the great problems associated with public housing. In most countries during the decades ahead, public control of the housing market may not be in the best interests of society or of those who need shelter. Short of the actual provision of homes, however, governments can do a great deal more to influence those key factors that determine housing conditions—the demand for shelter and the supply of housing resources.

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To influence future housing demand, family planning programs must be strengthened immediately. The next housing boom has already been born: the babies of the late sixties and early seventies will begin entering the housing market within two decades. Much of the demand for shelter in the twenty-first century will be determined by the decisions millions of these couples make about family size.

In rapidly growing developing countries, the demand for family planning information and services already outstrips available funds and the gap is growing. The U.N. Fund for Population Activities estimates that national and international expenditures for population programs need to double, to $3 billion annually. This would involve increasing family planning's overall share of development aid from 2 to 5 percent and raising the portion of public expenditures that developing countries allocate to family planning to about the same level.[89] It is becoming clear that these funds can be used most effectively in community-based programs, modeled perhaps on the highly successful efforts in Indonesia, South Korea, and China. In these countries, the villagers who must cope with future housing shortages and other population-induced difficulties are themselves responsible for family planning motivation and the distribution of contraceptives.

Governments in industrial countries can try to dampen demand through policies aimed at changing patterns of household formation. Tax deductions that encourage adults to have their parents live with them would curtail future demand for housing for the elderly. Removing local restrictions on unrelated people living together and encouraging banks to lend money to such groups would promote house sharing and a more efficient use of existing residential space. To date, only homeowners receive tax benefits for housing costs. Tax breaks

"Third World governments may want to focus their limited housing resources on providing basic services that the poor can ill afford themselves."

for renters would ease the pressure on housing prices, permit rents to rise, and thus encourage the construction of more rental housing and the conversion of large existing single units into several smaller ones. Obviously, governments must be careful not to impinge on people's freedom to choose how and with whom they live. But the sensitive political nature of the issue should not inhibit public officials from encouraging patterns of household formation that conserve housing resources.

On the supply side, most societies can no longer afford to leave the availability and price of key housing resources solely to the marketplace. National housing plans and policies have focused almost exclusively on the number of homes constructed, with little attention to the resources needed to build them. It has been assumed that housing resources will always be available in adequate varieties and quantities. In an era of abundance, this approach made sense. But now that environmental, economic, and political conditions limit the availability of resources, building better housing for all will first require better management of land, materials, energy, and capital.

Wherever possible, government policies should work to improve people's access to appropriate housing resources. For example, Singapore's Housing and Development Board has safeguarded supplies of building materials by establishing quarries and brickyards and by stockpiling and bulk ordering for its own construction program to ensure that no bottlenecks hamper projects.[90] By providing sewage facilities, water, electricity, and roads at certain sites, governments can increase the amount of land suitable for residential development while steering urban growth away from the best farmland. Third World governments may want to focus their limited housing resources on providing these basic services that the poor can ill afford for themselves. Political pressures to establish unrealistically low prices for capital and energy must be resisted. In the past, such subsidies have encouraged needless consumption and, in the Third World, have led sellers to withhold supplies from the market, so that the poorest people have had even greater difficulty obtaining them.

Planning to meet tomorrow's housing resource needs must take place at international, national, and local levels. Governments can provide the framework—a series of forums, perhaps—within which policy choices can be made. For example, nations that import building ma-

terials need to sit down with exporters. They may discover that the timber now being grown in the U.S. Pacific Northwest is being counted on to build houses in both Japan and southern California. When long-term domestic lumber requirements are plotted out against expected foreign demand and other forest-product needs, the importance of alternative construction materials becomes clear. At the national level, private and public homebuilders and representatives of mining, lumber, and oil companies need to coordinate their planning as well, to ensure that the houses being built reflect projected trends in resource availability. The alternative to planning is the boom-and-bust cycle experienced in the American lumber industry, where the gearing up and closing down of facilities contributes to rising costs and discourages capital investment.

At the local level, developers, homebuyers, and renters should be able to sit down and discuss the type of housing people want—single- or multifamily, rental or owner-occupied—and the types of amenities they expect. When several U.S. developers initiated such dialogues in 1980 and 1981, the response was good in terms of sales and buyer satisfaction."[1] Such planning could help avoid a repeat of problems in the late seventies, when builders continued to construct energy-inefficient homes long after it became apparent that the energy crisis was here to stay and that consumers wanted a new "model" home.

Resource planning will work best in conjunction with a redesign of residential development policies. Governments have so far shown little understanding of the resource implications of emerging housing patterns. For two generations, transportation policies, government-backed housing loans, unrealistically priced energy, and tax codes have all worked to segregate the activities of daily life—home, work, recreation, and shopping. This is a luxury societies can no longer afford. More compact development, including building on neglected or underused urban and suburban sites, will conserve land, energy, materials, and capital.

A number of government initiatives could encourage this compact development, such as the establishment of minimum density requirements to promote house clustering and the efficient use of land. Increased public transit grants will spur housing along transit lines while saving gasoline and reducing the need to build roads and parking areas. Permitting residential, commercial, and service sector activi-

"Inappropriate housing standards, zoning ordinances, and building codes can add to the cost of a house."

ties in the same neighborhood can help create self-contained urban villages. In 1980, a planning exercise involving the U.S. Department of Energy and five large commercial homebuilders demonstrated that such efforts could save developers money while cutting construction and lifetime energy use by 20 percent, thus holding down housing prices.[92]

The final element of supply-oriented housing policies involves government restraint rather than encouragement. Inappropriate housing standards, zoning ordinances, and building codes can add to the cost of a house. A 1978 U.S. Government study found that one-third of all communities did not permit homes to be sold with unfinished rooms, which means consumers in those areas miss a chance to lower their overall housing costs by slowly upgrading their homes as they can afford it. And in Connecticut, an American Bar Association report in the mid-seventies found that more than half the vacant land zoned for residential development was limited to lots of one and two acres, driving up the price of housing and effectively excluding low- and moderate-income families.[93] Regional zoning standards that required a range of housing density would make better use of land and bring homeownership within the reach of more people.

Local building codes are also frequently an obstacle. They often set standards requiring that walls be constructed of brick, so many inches thick, rather than that a wall of whatever material must insulate to a given degree and bear a given load. Specifications for performance rather than for components would give homebuilders and renovators greater leeway to construct less expensive and more appropriate dwellings. In the Third World, many governments still depend on regulations established by colonial governments for European-style housing. The materials and performance they require are so far beyond the resources of most homebuilders that nearly all low-income homes violate the law. Standards that reflect age-old local building techniques are more likely to be within the construction capabilities and resources of the people in the area and will often be more suited to local climatic conditions and available building materials. Overall, government standards should attempt to strike a balance between what is affordable for both individuals and society at large.

Supply-oriented policies need to be backed up with public resources. A 1978 survey of 15 multilateral aid agencies by the International

Institute for Environment and Development found that during their entire existence they had committed only 1.8 percent of their loans and grants to housing, sites-and-services projects, slum upgrading, urban development, and transportation projects. A scant additional 0.5 percent of their funds had gone to building-materials projects, largely to cement plants. At least a doubling of these resources is urgently needed. One encouraging development in the late seventies was a loan by the United Nations Environment Programme to the Sudanese Government to build a mobile asfadobe plant that will manufacture 20 million bricks a year, a major departure from usual multilateral-aid projects.[94] In addition, the current housing programs of the World Bank and AID, which focus their lending on efforts to help people shelter themselves through resource-conserving self-help housing programs, are salutory examples of major bureaucracies learning from past mistakes and developing new, progressive programs.

At the national level, government funds may be most effectively used to mobilize housing resources, but it will be expensive. West Germany's savings subsidies cost $900 million per year. The tax-free U.S. "All-Savers Certificates" created in 1981 are expected to cost the U.S. Treasury $1.1 billion in 1984.[95] While these costs seem staggering, they generate far more housing than comparable direct government expenditures. Similarly, guaranteeing loans to land banks and funding land-use planning will be costly but will enable society to use limited resources wisely.

These and other housing initiatives have never been needed more. Over the next two decades the housing sectors of both modern and traditional societies face unprecedented pressures. The needs of a growing population and the demands generated by the concentration of income in the hands of a few are now compounded by the spiraling costs and dwindling availability of housing resources. Unless these problems are addressed directly, rising housing prices in the industrial world could create a politically dangerous division between a dwindling number of homeowners and all the people who cannot afford to buy a house of their own. In the Third World, lack of access to housing resources could undermine efforts to improve housing quality and condemn millions to live in squalor.

New and innovative use of existing housing resources can, however, create a more positive housing future. Although most people in West-

ern Europe, North America, and Japan should expect to live in smaller, less resource-intensive homes, the quality of their lives will not be severely diminished. At the same time, the poor in the developing world will have the opportunity to improve their housing conditions in a way that is both economically and environmentally sustainable. By better managing supplies of land, building materials, energy, and capital, society can increase the chances that today's children will live in better housing than their parents now do.

Notes

1. Department of Economic and Social Affairs, *World Housing Survey, 1974* (New York: United Nations, June 1976); Policy Planning and Program Review Department, *Global Estimates for Meeting Basic Human Needs: Background Paper* (Washington, D.C.: World Bank, August 1977); figure on water and sewage is author's estimate based on World Health Organization, *Drinking Water and Sanitation, 1981-1990* (Geneva: 1981).

2. Economic Commission for Europe ,Geneva), *Annual Bulletin of Housing and Building Statistics for Europe* (New York: United Nations, various issues); Bureau of the Census, "New One-Family Houses Sold and For Sale," U.S. Department of Commerce, Washington, D.C., March 1981; Bureau of the Census, *Characteristics of New One-Family Homes: 1970* (Washington, D.C.: U.S. Department of Commerce, 1971); "New Home Costs Rose 23% in Japanese Cities in '80," *Asian Wall Street Journal*, June 6, 1981.

3. Henry Morton, "The Soviet Quest for Better Housing—An Impossible Dream?," U.S. Congress, Joint Economic Committee, *Soviet Economy in a Time of Change*, Vol. 1, Committee Print, October 10, 1979; World Bank, *Housing Sector Policy Paper* (Washington, D.C.: May 1975).

4. National Broadcasting Corporation, "May National Poll," press release, New York, N.Y., June 4, 1981; Shinichiro Sekikawa, "Memorandum," National Land Agency, Tokyo, November 13, 1980; George Gallup, "Americans Today Seen More Satisfied with Basic Aspects of Life than in '75," press release, Princeton, N.J., June 1, 1978.

5. United Nations Fund for Population Activities (UNFPA), *United Nations Fund for Population Activities: 1980 Report* (New York: 1981); "World Population Data Sheet 1981," Population Reference Bureau, Washington, D.C., 1981.

6. Population Division, *World Population and Its Age-Sex Composition by Country, 1950-2000: Demographic Estimation and Projections as Assessed in 1978* (New York: United Nations, January 1980).

7. Kathleen Newland, *City Limits: Emerging Constraints on Urban Growth* (Washington, D.C.: Worldwatch Institute, August 1980).

8. "World Population Data Sheet 1981"; United Nations Fund for Population Activities, *Population and the Urban Future*, Background Documents for International Conference, Rome, Italy, September 1-4, 1980.

9. Dwight Jaffee and Kenneth Rosen, *Demand and Production in the Housing Industry: 1979-1988* (Washington, D.C.: National Association of Home Builders, 1979).

10. Sekikawa, "Memorandum", "Some Experts Foresee a Collapse in Prices for Houses and Offices," *Wall Street Journal*, January 28, 1981.

11. Statistical Office, *Demographic Yearbook Historical Supplement 1979* (New York: United Nations, 1979); Bureau of the Census, *Annual Housing Survey: 1978* (Washington, D.C.: U.S. Department of Commerce, 1979).

58

12. Author's calculations based on Population Division, *World Population and Age-Sex Composition*.

13. Earl Gottschalk, Jr., "Doubling Up: House Sharing Spreads As Buyers Find a Way to Meet High Prices," *Wall Street Journal*, April 17, 1981; Jeannye Thornton, "Why So Many Families are Doubling Up," *U.S. News and World Report*, March 9, 1981.

14. Bureau of the Census, *Statistical Abstract of the United States 1979* (Washington, D.C.: U.S. Department of Commerce, 1979).

15. Author's calculations based on Department of Economic and Social Affairs, *Compendium of Housing Statistics, 1975-1977* (New York: United Nations, 1980).

16. Economic Commission for Europe, *Annual Bulletin of Housing and Building Statistics for Europe*, various issues; Dept. of Economic and Social Affairs, *Compendium of Housing Statistics*.

17. U.S. and West European figures in Economic Commission for Europe, *Annual Bulletin of Housing and Building Statistics*, various issues; Morton, "Soviet Quest for Better Housing."

18. Bureau of the Census, *Annual Housing Survey: 1978*.

19. Economic Commission for Europe (Geneva), *Major Trends in Housing Policy in ECE Countries* (New York: United Nations, 1980); Statistical Office of the European Communities, *Social Indicators for the European Community, 1960-1978* (Belgium: European Community, 1980).

20. Bureau of the Census, "Housing Starts," U.S. Department of Commerce, Washington, D.C., June 1981; Bureau of the Census, *U.S. Census of Housing, 1970: U.S. Summary* (Washington, D.C.: U.S. Department of Commerce, 1973); Bureau of the Census, *Annual Housing Survey: 1978*.

21. Robert Sheehan, National Association of Home Builders, private communication, July 23, 1981; Bureau of the Census, *Characteristics of New Housing: 1980* (Washington, D.C.: U.S. Department of Commerce, 1981); Economic Commission for Europe, *Major Trends in Housing Policy*.

22. Bureau of the Census, *Annual Housing Survey: 1978*; William C. Baer, "Empty Housing Space: An Overlooked Resource," in Robert Montgomery and Dale Rogers Marshall, *Housing Policy for the 1980s* (Lexington, Mass.: D.C. Heath and Company, 1980).

23. Bureau of the Census, *U.S. Census of Housing, 1960: U.S. Summary* (Washington, D.C.: U.S. Department of Commerce, 1963); Bureau of the Census, *Annual Housing Survey: 1978*.

24. Dept. of Economic and Social Affairs, *Compendium of Housing Statistics*.

25. UNFPA, *Population and the Urban Future*.

26. Jorge E. Hardoy and David Satterthwaite, *Shelter: Need and Response* (New York: John Wiley & Sons, 1981).

27. Roger Mann, "Solving the Housing Problem," *Africa Report*, May/June 1978.

28. Anil Agarwal, *Mud, Mud* (London: International Institute for Environment and Development, 1981).

29. Dept. of Economic and Social Affairs, *Compendium of Housing Statistics*; Hardoy and Satterthwaite, *Shelter: Need and Response*; Judith Kossy, "Community Development in Contemporary China," U.S. Department of Housing and Urban Development, Washington, D.C., unpublished, 1979.

30. World Health Organization, *Drinking Water and Sanitation*; Earthscan, "Habitat—Five Years After," London, June 1981.

31. In Table 5, materials costs from Economic Commission for Europe, *Annual Bulletin of Housing and Building Statistics: 1979* (New York: United Nations, 1980); financing costs from Hani Findakly, World Bank, private communication, August 3, 1981; labor costs from International Labor Office, *Yearbook of Labor Statistics: 1980* (Geneva: 1980); Canadian land prices from Canada Mortgage and Housing Corporation, *Canadian Housing Statistics: 1979* (Ottawa: 1980); French land prices from "Les Grandes Tendances du Marché de la Maison Individuelle," *Problèmes Economiques*, July 2, 1980; Japanese land prices from National Land Agency, *The Outline of Annual Report on the National Land Use* (Tokyo: 1980); U.S. land prices from "Land Trends" (newsletter), Homer Hoyt Institute, Washington, D.C., August 1981; energy prices from Congressional Research Service for the U.S. House of Representatives, Committee on Interstate and Foreign Commerce, *The Energy Factbook*, Committee Print, November 1980; CPI from Department of International Economic and Social Affairs, *Monthly Bulletin of Statistics* (New York: United Nations, May 1981).

32. Department of Economic and Social Affairs, *Land for Human Settlements* (New York: United Nations, 1977).

33. *Ibid.*

60 34. "Land Trends," Homer Hoyt Institute; National Land Agency, *Outline of Annual Report;* Jay Miller, "ULI Land Price Survey," Urban Land Institute, Washington, D.C., 1980; Alan Carroll, *Pirate Subdivisions and the Market for Residential Lots in Bogota* (Washington, D.C.: World Bank, 1980).

35. Bill Young, National Association of Home Builders, private communication, August 17, 1981; "Les Grandes Tendances"; Carroll, *Pirate Subdivisions.*

36. The author visited Netzahualcoyotl in Mexico in August 1978.

37. "Economic News Notes" (newsletter), National Association of Home Builders, Washington, D.C., September 1979; Dept. of Economic and Social Affairs, *Land for Human Settlements.*

38. "Land Trends," Homer Hoyt Institute; "Les Grandes Tendances"; National Land Agency, *Outline of Annual Report.*

39. Carol Anderson, "Coping With the Recession," *Builder,* June 1, 1981.

40. Hardoy and Satterthwaite, *Shelter: Need and Response;* Dept. of Economic and Social Affairs, *Land for Human Settlements.*

41. Hardoy and Satterthwaite, *Shelter: Need and Response.*

42. Charles E. Little, "Farmland Conservancies: A Middleground Approach to Agricultural Land Preservation," *Journal of Soil and Water Conservation,* September/October 1980.

43. Sekikawa, "Memorandum."

44. Hardoy and Satterthwaite, *Shelter: Need and Response.*

45. Forest Service, *An Analysis of the Timber Situation in the United States 1952-2030* (review draft) (Washington, D.C.: U.S. Department of Agriculture, 1980); Timber Division, Economic Commission for Europe/Food and Agriculture Organization (ECE/FAO), *European Timber Trends and Prospects 1950 to 2000* (Geneva: 1976).

46. Roger A. Sedjo, ed., *Issues in U.S. International Forest Products Trade* (Washington, D.C.: Resources for the Future 1981); Timber Division, ECE/FAO, *European Timber Trends.*

47. Barry Bosworth, "Testimony," U.S. Senate Committee on Banking, Housing, and Urban Affairs, Hearings, October 21, 1977; Bureau of Labor Statistics, "Producer Prices and Price Index" (monthly), U.S. Department of Labor, Washington, D.C., various issues; Food and Agriculture Organization (FAO), *Forest Products Prices 1961-1980* (Rome: 1981).

48. Forest Service, *Analysis of the Timber Situation*; Timber Division, ECE/FAO, *European Timber Trends*.

49. Lester R. Brown, *Building a Sustainable Society* (New York: W. W. Norton & Co., 1981); FAO, *Forest Products Prices*.

50. Bureau of Mines, *Minerals Yearbook* (Washington, D.C.: U.S. Department of the Interior, 1978-79); "International Country Profiles," U.S. Department of Housing and Urban Development, Washington, D.C., various issues.

51. Economic Commission for Europe, *Annual Bulletin of Housing and Building Statistics: 1979*; Bureau of Labor Statistics, "Producer Prices," various issues.

52. Richard Critchfield, *Villages* (New York: Doubleday, 1981); Nyerere and Noui-Mehedi quoted in Agarwal, *Mud, Mud*.

53. Fernand Braudel, *Capitalism and Material Life, 1400-1800* (New York: Harper & Row, 1973).

54. Herold Gerbrandt and Gerald W. May, "The Extent of Adobe Use in the United States," University of New Mexico, Albuquerque, N.M., unpublished, undated.

55. Costs of bricks in Sudan from Agarwal, *Mud, Mud*; Hardoy and Satterthwaite, *Shelter: Need and Response*.

56. Hardoy and Satterthwaite, *Shelter: Need and Response*; Virginia Morell, "Builder Makes Houses of Rammed Earth," *Los Angeles Times*, February 15, 1981.

57. Steve Frazier, "Adobe is Adorable, But Today's Pueblos Can't Build With It," *Wall Street Journal*, February 4, 1980.

58. Daniel E. Peters, "Entering the Fast Track: A Survey of the Coming Revolution in Building Materials and Design," *Metal Building Review*, April 1980.

59. Bruce Hannon *et al.*, "Energy and Labor in the Construction Sector," *Science*, November 24, 1978; Denis Hayes, *Rays of Hope: The Transition to a Post-Petroleum World* (New York: W. W. Norton & Co., 1977).

60. Hannon, "Energy and Labor."

62

61. Energy component of cement production costs from Charles Pitcher, U.S. Department of Commerce, private communication, July 20, 1981; Bureau of Mines, *Minerals Yearbook*; Agarwal, *Mud, Mud*.

62. "Housing and Urban Development in the Federal Republic of Nigeria" (Country Profile), U.S. Department of Housing and Urban Development, Washington, D.C., July 1977; Agarwal, *Mud, Mud*.

63. Hannon, "Energy and Labor"; Scanada Consultants Limited, "Choice of Materials Energy Into Production and Delivery of Wood-Based and Other Housing Materials and Systems," paper prepared for seminar on the Impact of Energy Considerations on the Planning and Development of Human Settlements, Ottawa, October 3-14, 1977.

64. Dale L. Keyes, "The Influence of Energy on Future Patterns of Urban Development," in Arthur P. Solomon, *The Prospective City* (Cambridge, Mass.: The MIT Press, 1980).

65. Michael deCourcy Hinds, "Despite a Trend Toward Conservation, New Homes Are Called Energy Sieves," *New York Times*, December 28, 1980.

66. Jacquelyn R. Jackson, "Energy Takes a Growing Role in What People Want in Housing," *Baltimore Sun*, March 29, 1981.

67. Richard Stein, *Architecture and Energy* (New York: Anchor Press/Doubleday, 1978); Bruce Hannon, University of Illinois, private communication, June 9, 1978.

68. Christopher Flavin, *Energy and Architecture: The Solar and Conservation Potential* (Washington, D.C.: Worldwatch Institute, November 1980).

69. Third World investment in housing from Anthony A. Churchill, *Shelter* (Washington, D.C.: World Bank, September 1980); Dr. Peter Treadway, *The Economic Environment for Housing: 1981 and Beyond* (Washington, D.C.: Federal National Mortgage Association, February 1981).

70. Sandy Zimmer, New York Office of Chase Manhattan Bank, private communication, August 3, 1981; Michael P. Todaro, with Jerry Stilkind, *City Bias and Rural Neglect: The Dilemma of Urban Development* (New York: The Population Council, 1981).

71. Bureau of the Census, "Housing Starts" (monthly), U.S. Department of Commerce, Washington, D.C., various issues.

72. U.S. Federal Home Loan Bank Board, "Savings and Loan Activity" (monthly), press release, various issues.

73. Anthony Downs, "Are We Using Too Much Capital for Financing Housing?," presented to the Advisory Committee of the Federal National Mortgage Association, Washington, D.C., June 1980; Treadway, *Economic Environment for Housing*.

74. The author lived in the Emmertsgrund in Heidelberg, West Germany, in 1974.

75. Kenneth H. Bacon, "The Outlook: Searching for a Policy for More Saving," *Wall Street Journal*, July 6, 1981.

76. Carroll R. Melton, *Saving and Lending for Homeownership* (Chicago: International Union of Building Societies and Savings Associations, 1980).

77. James M. Poterba, *Inflation, Income Taxes, and Owner-Occupied Housing* (Cambridge, Mass.: National Bureau of Economic Research, 1980).

78. Urban Institute study quoted in Rolf Goetze, "The Housing Bubble," *Working Papers*, January/February 1981.

79. James W. Christian, *Housing Finance for Developing Countries* (Chicago: International Union of Building Societies and Savings Associations, 1980).

80. *Ibid.*

81. Braudel, *Capitalism and Material Life*.

82. Kenneth R. Harney, "Real Estate: Going Up," *New Shelter*, February 1981; future costs of commercial homes in Third World is author's calculation based on Tomasz Sudra, "Can Architect and Planner Usefully Participate in the Housing Process?—The Case of Ismailia," mimeographed, February 1979.

83. Robert Lindsey, "Home of Future: Size Will Shrink But Not the Price," *New York Times*, January 25, 1981.

84. Virginia Morell, "A Place in the Sun: Mike Corbett's Village Homes," *New Age*, February 1981.

85. Baer, "Empty Housing Space: An Overlooked Resource."

86. Carroll, *Pirate Subdivisions*.

87. Churchill, *Shelter*.

88. World Bank figure from Bruce Stokes, *Helping Ourselves: Local Solutions to Global Problems* (New York: W. W. Norton & Co., 1981); U.S. Congressional Budget Office, "The Long-Term Costs of Lower-Income Housing Assistance Programs," Washington, D.C., March 1979.

64

89. *Family Planning in the 1980's: Challenges and Opportunities*, recommendations of the International Conference on Family Planning in the 1980's, United Nations Fund for Population Activities, Djakarta, Indonesia, April 26-30, 1981.

90. Hardoy and Satterthwaite, *Shelter: Need and Response*.

91. Malcolm Sherman, Ackerman and Company, private communication, July 26, 1981.

92. Gerald Leighton, U.S. Department of Energy, private communication, July 27, 1981.

93. General Accounting Office, "Why Are New House Prices So High, How Are They Influenced By Government Regulations, and Can Prices Be Reduced?," Washington, D.C., May 11, 1978.

94. Hardoy and Satterthwaite, *Shelter: Need and Response*.

95. Melton, *Saving and Lending*; Phil Morrison, Senate Finance Committee, private communication, August 24, 1981.

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